TED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

AUGUST, 1947 VOL. 45 • NUMBER 8

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Published Monthly by
METAL INDUSTRY PUBLISHING CO., INC.
11 West 42nd St. New York 18, N. Y.
Telephone: PEnnsylvania 6-0226

also publishers of
Organic Finishing, monthly, $1.00 per year
Guidebook-Directory for the Metal Finishing Industries, annually, $1.50

Copyright 1947 by The Metal Industry Publishing Company, Incorporated. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, $3.00 and Canada, $3.00 per year. Other countries $7.50. Single copies 35c in U. S. and Canada, Foreign 75c. Please remit by check or money order; cash should be registered.

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DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

VOLUME 45 • NUMBER 8 • AUGUST, 1947

Finishing Plant Safety

Safety in the finishing plant is one of the most important features of successful operation, but one which to a great many executives give the minimum amount of attention. Safety measures in the plating room are generally a result of makeshift methods which result from previous accidents. It is quite true that legislating safety is a difficult thing; the plating tank operator dislikes wearing gloves, the polisher feels it beneath his dignity to wear goggles.

However, there are many ways in which safety can be practiced in the finishing plant. Equipment is available to eliminate almost all the hazards encountered: proper exhaust systems, drainage facilities, safety clothing and utensils, etc. Yet costly accidents occur, due mainly to failure of available equipment, failure to use existing equipment and methods, or failure to have adequate safety measures on hand. All three are essentially the responsibility of the finishing executive.

To eliminate failure of available safety equipment requires constant inspection and maintenance on the part of supervision: this is as much a part of the job as meeting production schedules. Failure to use existing safety equipment and methods is one of the least excusable acts of the finishing executive; he must insist that safety be practiced at all times; he must set the example and by means of leadership and understanding eliminate carelessness in applying safety methods; he must demonstrate the use of proper safety equipment. Obviously, the failure to have adequate measures in operation in the finishing plant is deplorable. Safety equipment and methods are required by various federal, state and local regulations before a finishing plant can be operated. This at best, is of course general, primarily because operations in the finishing shop are often of a special nature, meaning that plant supervision must be able to designate where and what safety measures must be taken for a given setup.

Safety should first be considered from the standpoint of individual harm; no one in supervision would intentionally inflict pain and suffering on the operator down the line; this is substantially what is done when safety measures are neglected. Another consideration of safety is in production-dollar values. Lost-time accidents can be extremely costly, not only from loss of time and consequently loss in production, but in possible subsequent medical expenses. Accidental contamination of a solution, fire in an exhaust duct, flash-over of electrical equipment are a few of the items which may be financially disastrous.

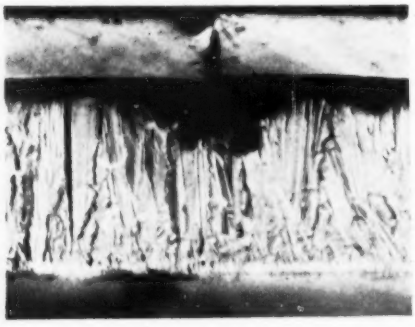
That the old saying, *an ounce of prevention is worth a pound of cure*, has great significance in the finishing plant, is proved by better relations and output in plants whose supervisors are safety conscious.

Abstracts of Papers Presented at 34th Annual A. E. S. Convention

STRESS in Electrodeposits—Its Significance, by K. Gustaf Soderberg and A. Kenneth Graham, Graham, Crowley and Associates, Inc., Jenkintown, Pa.

Having defined the expressions of stress and strain, the authors offer a review of the literature in which special attention is focused on methods of measurement of internal stress. A portion of the total stress is often of thermal origin (bi-metallic strip action), but this is usually small compared with the total stress. "True" internal stress is believed to be tied in with high metal overvoltage phenomena.

Edge cracks and surface cracks in copper-nickel-chromium plate on SAE 1085 steel after 3 months outdoor exposure in Pittsburgh. x9.



Cross section of a nickel surface check crack with corrosion point in copper coating underneath, after 6 months outdoor exposure. x1000.

The authors have found minute cracking in nickel deposits on outdoor exposure test panels, with and without preliminary copper coatings. These fine check cracks have in the past been considered pores in the coating. The configuration and the size of the cracks have been found to depend on properties of the base metal and on the cleaning procedure employed on preliminary buffed copper coatings. Since the stresses in the nickel deposits were of lower magnitude than their tensile strength, the mechanism of cracking is believed to be one of stress corrosion or of stress concentration at imperfections in the coatings.

New methods of determination of internal stress as well as of calculating the stress were presented.

Some stress data were given for nickel deposits from all-sulfate, Watts type, all-chloride, and fluoborate nickel baths.

Stress in Electrodeposited Nickel, by W. M. Phillips and F. L. Clinton, General Motors Research Division.

The authors present a quantitative method to determine and evaluate stress, what effect it has on the serviceability of electrodeposited metal, why it has a detrimental effect and how it can be alleviated. In effect, the paper is a progress report of stress analysis and other factors conducted by General Motors' various divisions.

The authors state that the stress which exists in electrodeposited nickel is affected by some of the variables under which the plating bath is operated. It was found in a Watts nickel bath that the three basic salts, single nickel salt, nickel chloride and boric acid produce a tensile stress of approximately 14,000 psi. However, the nickel chloride causes an appreciable increase in tensile stress when the concentration exceeds 4 oz./gal. pH in the same bath causes increased tensile stress as it becomes higher, while raising the operating temperature decreases the tensile stress. However, there is a wide range of operating temperatures in heated baths before any appreciable change in stress is encountered. Current density has no appreciable effect on stress in the Watts bath in the range of 20-50 amperes per sq. ft., nor does the varying thickness of plate up to 0.002"; however, thicker deposits result in lower tensile stressed nickel. Neither agitation nor hydrogen embrittlement seem to have any measurable effect on stress, according to the authors, although hydrogen embrittlement does produce a considerable decrease in ductility. Impurities and addition agents increase stress considerably.

Conclusions drawn by the authors include statements that the majority of stress lies in the nickel plate in a composite plate of copper, nickel and chromium. Since the stressed nickel is to accelerate the rate of plate failure, the stress can be held to a minimum value by means of keeping the pH at the lowest operating value, maintaining the maximum temperature, careful control of addition agents and taking precautions to plate from a clean and pure bath. In addition, the decorative chromium should be held to the minimum thickness as salt spray tests prove conclusively that heavy deposits of chromium increase the rate of failure as compared with thin deposits.

Physical Properties of Electrodeposited Chromium, by Abner Brenner, Polly Burkhead and Charles W. Jennings, National Bureau of Standards, Washington, D. C.

The following were obtained on a large number of deposits produced

Charles L. Faust, Chairman
First Educational Session

under various plating conditions: hydrogen and oxygen contents, hardness, density, tensile strength, Young's modulus, ductility and electric resistivity. The effect of heat treatment up to 1200°C on some of these properties was determined. In addition, observations were made on the cathode current efficiency of plating and on stress in the deposits as plated. The chromium deposits plated at elevated temperature were much sounder mechanically than the bright deposits produced at about 50°C.

Bright Brass Plating of Die Castings, by Stanley J. Beyer, Hart Manufacturing Company, Louisville, Ky.

A high lustrous brass coloring is obtained by applying copper and bright nickel with a final thin coating of brass. Plating conditions and analytical procedure for the brass bath are given.

Modern Applications of Electroplating Solution Purification, by B. C. Case, Hanson-Van Winkle-Munning Company, Detroit, Mich.

Bright nickel baths are more sensitive to impurities than dull nickel baths and require regular control and removal of the impurities.

Bright nickel solutions are best freed from copper and lead, which plate out satisfactorily at 2-4 asf, and from zinc and iron, which require 6-7 asf, by using a suitably corrugated cathode with an overall current density of 5 asf. The removal is accomplished without changing bath temperature or bath pH by pumping the solution through special purification tanks in which they are thoroughly agitated for maximum rate of removal.

Organic impurities are best removed by activated carbon treatment. Only such bright nickel baths which contain brighteners that are not absorbed by activated carbon can be treated continuously, others must be batch treated at intervals.

The paper contains urgently needed engineering data for the construction and operation of purification systems with old as well as new installations.

Electroforming Pitot Static Tubes, by Alfred S. Kasdan, Kollsman Instrument Division of Square D Company, Elmhurst, N. Y.

The pitot static tube is used to collect pitot pressure for actuating the air speed indicator as well as static pressure for operating the air speed indicator, the vertical speed indicator and the altimeter on aircraft. The shells were electroformed to insure maximum heat transmission and because they are so complicated that they cannot be readily manufactured by other methods.

The lead-bismuth eutectic serves as mandrel material and is cast around the skeleton parts in a die casting machine. Elaborate cleaning techniques are used to insure air-tight joints, after which the material is plated with agitation in a standard copper sulphate bath containing phenol sulfonic acid, fish glue and aerosol. A minimum of 0.075 inch copper is applied. After grinding and polishing the alloy is melted out in an oil bath and the tube is cleaned, acid dipped, cyanide struck and gray nickel plated.

Deposition of Nickel and Cobalt by Chemical Reduction, by Abner Brenner and Grace Riddell, National Bureau of Standards, Washington, D. C.

This is a continuation of the work reported in 1946 on deposition of nickel from an ammoniacal solution containing hypophosphites. The process has now been extended to include deposition of nickel from acid solutions containing 30 g./l. nickel chloride, 10 g./l. sodium hypophosphite, and 10-50 g./l. of sodium hydroxyacetate or 10 g./l. of sodium citrate at a pH of 4 to 6. All deposits were semi-bright, and the rate of deposition was as high as 0.0006 inch per hour in the hydroxyacetate bath. Good cobalt or cobalt-nickel coatings could not be had from acid solutions but were obtained in alkaline solutions. The most rapid cobalt bath, which deposited 0.0006 inch per hour, contained 30 g./l. cobalt chloride, 20 g./l. hypophosphite, 35 g./l. sodium citrate, 50 g./l. ammonium chloride and sufficient ammonium to raise the pH to 9-10. These deposits were dull. With nickel chloride in the ammoniacal cobalt bath, semi-bright cobalt-nickel alloys were obtained at the same rate.

Certain metals and radicals, cadmium and sulphocyanide, had a detrimental effect in all the baths, copper and lead were detrimental both in alkaline and in acid nickel baths, zinc reduced the rate of deposition in the alkaline nickel and cobalt baths, and magnesium and ferrous iron had the same effect in the alkaline cobalt bath only.

The deposition takes place only on certain surfaces that catalyze the process, namely on iron, nickel, active gold, cobalt, aluminum and palladium. Deposition can be obtained on non-catalytic metals such as platinum, copper and brass if momentary contact is made with an electronegative metal such as aluminum or iron, or a thin layer of a catalytic metal such as palladium is first applied to the surface by immersion. No success was had with deposition on plastics.

Recent Developments in the Use of Conversion Coatings on Zinc, by J. D. Stareck and W. S. Cibulskis, United Chromium, Inc., Detroit, Mich.

This paper sets forth the results of

Floyd P. Oplinger, Chairman
Second Educational Session

salt spray tests and outdoor exposure in a South Florida atmosphere on steel panels coated with 0.00005-0.0005 inch thick cyanide zinc films with and without various thicknesses of electrolytically and chemically applied supplementary films of the chromate type. All of these coatings increase the time in the salt spray which elapses before white corrosion forms, and most of them have the same effect in the outdoor exposure. The time for first rust to appear in the salt spray is also increased, especially with the thinner zinc deposits. In general, the anodic type of conversion coating gives the best protection. The purer the zinc deposits and the smoother the base metal the better are the results obtained.

A number of practical applications of the conversion coating are listed. Outstanding among them are refrigerator shelves finished with a clear conversion coating and a clear synthetic organic finish.

Bulk Nickel Plating, by Henry Strow, MacDermid, Inc., Waterbury, Conn.

The importance of various features of modern nickel plating barrels are emphasized. Two types of barrel plating solutions are recommended: The first one contains 24-40 oz./gal. of nickel sulfate, 6-10 oz./gal. nickel chloride, 4-5 oz/gal. boric acid, 24-32 oz./gal. magnesium sulfate, and a brightener. The preferred pH range is 5.2 to 5.6. With nickel sulfate, nickel chloride and boric acid toward the lower limit, the bath is used near room temperature at 6-8 volts. Twelve volts and 120-130°F are used with the high concentrations and a conventional barrel will draw up to 400 amperes. The second bath contains 20-25 oz./gal. nickel sulfate, 20-25 oz./gal. nickel chloride, 5 oz./gal. boric acid, and suitable organic brighteners. It is run at 120-130°F at a pH of 4.5-5 and has a very high conductivity. Because of the high chloride content, special care must be taken in the choice of materials and brighteners.

Details were given of cleaning and acid dipping techniques before plating as well as drying techniques after plating.

Barrel Chromium Plating, by G. Dubpernell and S. M. Martin, United Chromium, Inc., Waterbury, Conn. and New York City respectively.

Following a well illustrated historical review of previous attempts to chromium plate small parts in barrels and other tumbling equipment is a description of new equipment and methods which have proved commercially successful. The new barrel is an open-ended horizontal cylinder, with a bare steel inside surface and an insulated outside surface. A very deeply serrated lead anode is placed inside the cylinder during plating and swung out of the bath after plating so that the cylinder can be removed for emptying. Vigorous agitation is

Arthur McNeil, Chairman
Third Educational Session

used to maintain the desired bath composition inside the cylinder.

The speed of rotation of the cylinder is very low in order that the parts stay in electrical contact with the inside steel surface at all times.

The silicofluoride type chromic acid bath is employed, the sulfate type having too narrow range for uniform coverage of many parts.

There is a detailed description of how to plate different kinds of work as well as of pre- and post-treatments.

Not only decorative chromium coatings but also much heavier deposits has been applied in this equipment.

Standardization of Buffing and Preparation of Atmosphere Exposure Test Panels, by C. C. Cupps, Standard Steel Spring Company, Newton Falls, Ohio and A. Kenneth Graham, Graham, Crowley and Associates, Inc., Jenkintown, Pa.

Copper-nickel-chromium plated panels for outdoor exposure tests frequently require buffing of the copper or the nickel or both. Since specified minimum thicknesses are essential it has been found necessary to standardize the buffing loss. The results obtained by hand buffing were found to be very variable, and an automatic machine was developed which gives much more uniform results. This machine is described, and data are given on the results obtained with it and with hand buffing.

The machine is believed to be of value for the comparison of buffability of plated coatings.

Evaluation of the Buffability of Nickel Deposits, by R. O. Miller, Electric Auto Lite Corporation, Sharonville, Ohio and A. H. DuRose, Harshaw Chemical Corporation, Cleveland, Ohio.

Buffability is the ease with which lustrous finish is obtained and base metals' imperfections are covered or camouflaged, consideration being given to the amount of pull exerted by the buffing wheel on the plated piece.

The work was done on an automatic buffing machine so constructed that the pressure of the buff against the test panel as well as the pull of the buff on the test panel could be measured. The panels were made of hot rolled heat treated, air quenched, and pickled SAE 1085 steel and of a cold rolled NAX steel of the 9100 series as received from the mill. They were polished to various degrees of finish and scratched to different depths, then plated in a Watts type bath, a bright high chloride bath, a fluoborate bath, of three proprietory baths containing addition agents.

From the large amount of experimental data it is concluded that the luster after buffing depends greatly on the brightness prior to buffing but not on the base metal finish except when the latter is very rough. The coating thickness had only a negligible effect on luster. The ability to cover imperfections depends greatly on the finish of the base metal but not on the thickness of the deposit. Neither the Watts type nickel bath nor the all-chloride deposit filled any scratches, but the semi-bright and some of the special deposits did. The drag of the buffing wheel depends on the smoothness of

the deposit and its luster before buffing.

Results obtained by a hand buffer agreed in general with the mechanical results except that the buffer based his opinion more on the amount of drag and luster than on covering of scratches. Also, the buffer did not duplicate his results as well as the buffing machine.

Project No. 2—Extraction Methods Applied to the Analysis of Electroplating Baths and the Determination of Zinc and Other Impurities in Nickel Solutions. By E. J. Serfass and W. S. Levine, Lehigh University.

The authors explained the history of their project, which was transferred from the University of Illinois under direction of *G. F. Smith* to Lehigh University and placed under the direction of *E. J. Serfass*. The bibliography begun by Dr. Duke was greatly expanded, coded and arranged in order. In addition the bibliography was compiled to include all references to the determination of trace constituents in all types of plating baths. Several methods for determining various elements in plating solutions were developed.

In the determination of silica, a colorimetric method was developed wherein an acidified solution of ammonium molybdate was added to an aliquot of the bath, diluted to volume and allowed to stand for 15 minutes before measuring its transmittancy. For a "Stop and Go" method, the solutions were transferred to Nessler tubes and compared visually with standards of known silica concentration.

In the determination of chromium (hexavalent), a 0.5 gram sample is adjusted to an acidity of 0.2 N with nitric and sulphuric acid. Diphenylcarbazide reagent is added and the red violet complex formed. After dilution to 25 ml., the solution is mixed and measured for transmittancy with a colorimeter. For total chromium content the trivalent chromium in the sample is oxidized in acid solution with silver as a catalyst. The manganese which is also oxidized is reduced with a little HCL; diphenylcarbazide is added forming a red violet complex. The intensity of the color is then determined after centrifuging a portion of the solution.

In the determination of zinc, copper and iron are removed by precipitation with cupferron and extraction of cupferrides with n-amyl acetate. The solution is buffered and sodium diethanoldithiocarbamate added to form a metal ion complex. This is then converted to zinc dithizonate and extracted from the mixture with a solution of dithizone in CCl_4. After washing, the extract is diluted to volume with solvent and transmittancy measured.

In calcium determinations, the calcium is separated from the nickel and other heavy metals by precipitating the latter with NaOH at pH of 10.5. After filtering the precipitate, the calcium is precipitated as the oxalate at a pH of 3.7 and filtered. It is dissolved in dilute sulphuric acid, added to 2 ml. of a standard solution of $KNmO_4$ and after a short time, transmittancy measured.

E. T. Candee, Chairman
Fourth Educational Session

In determining aluminum, the nickel is removed along with some of the other heavy metals by the addition of sodium diethyldithiocarbonate and extracting the precipitate formed with chloroform. The aqueous layer is buffered to a pH of 5.5 with NH_4Ac and a red lake developed by the addition of aluminon. The transmittancy is measured a half hour after the aluminon addition.

Sodium determinations are carried out by means of adding a solution of magnesium uranyl acetate to a 2 ml. aliquot of the bath in a test tube. After suitable shaking, a suspension of sodium magnesium uranyl acetate is formed whose transmittancy is measured.

For determining ammonia, an aliquot of the bath is placed in a micro Kjeldahl flask through which a current of steam flows. NaOH is added and the mixture boiled. The ammonia liberated is carried out by the steam which is condensed and collected in a Nessler tube. The colored system is developed by adding Nessler's reagent and its transmittancy measured.

The comparatively new method for determining sodium and other alkali metals using a Flame Photometer was tested by the authors and found to have much promise for determining sodium in nickel plating baths. In this instrument, a sample of the bath is atomized and the fine spray made to enter the base of a burner, imparting a yellow color to the flame. The intensity of the color is proportional to the amount of sodium in the sample.

Project No. 4. Effect of Surface Finishing of Non-Ferrous Base Metals on the Protective Value of Plated Coatings. By George J. Kahan, U. S. Time Corp.

Conclusions reached in a previous project in 1945 were that variations in polishing procedure on steel showed no significant effect on the protective value of plated coatings. Project No. 4 undertakes to study surface finishing on alpha brass, cast brass and zinc base die castings with relation to the protective value on plated coatings. Three methods of surface finishing are to be used: physical-mechanical, electro-chemical and chemical.

Surface preparation cycles of the alpha brass will be: polished and buffed; buffed only; electropolished; bright dipped; polished with greaseless satin finish compound. The cast brass will be treated by polishing with coarse abrasive grain, buffing and coloring; polishing with fine abrasive grain, buffing and coloring. The zinc base die castings will be buffed and colored; polished to remove skin, buffed and colored.

The electrodeposited coatings on the panels as prepared above are to be as follows: alpha brass, bright nickel and chromium applied in thicknesses conforming with the heaviest A.S.T.M. specifications; cast brass, same as alpha brass; zinc base die castings, Rochelle copper flash, bright

copper plate, bright nickel plate and chromium plate in accordance with heaviest A.S.T.M. specifications.

Three exposure sites for the plated specimens are planned as follows: one to represent typical rural conditions; one to represent industrial conditions; and one to represent marine conditions.

Project No. 5. Some Effects of Copper in Nickel Plating Solutions. By D. T. Ewing and William D. Gordon, Michigan State College.

Project No. 5 is directed primarily to the determination of the effects of the presence of small amounts of metallic and organic substances in electroplating solutions with the removal of impurities from these solutions. The authors explained that only one solution would be investigated in the beginning, and nickel was selected. At present, investigations are going forward on the effects of various amounts of copper added to four types of nickel plating baths.

The four types of nickel baths selected were two Watts type solutions, one a high pH and the other a low pH solution; an alloy type bath; and the fourth a bath containing organic substances. The effects studied by addition of impurities were on such properties as ductility, appearance, adhesion, hardness, corrosion resistance, throwing power, coverage and distribution of deposit.

A number of panels of various thicknesses were prepared from each of the four nickel solutions, using the bent cathode. Effects of copper as an impurity in the quantity of 5, 10, 25, 50, 75 and 100 mg./l. of nickel solution showed the Watts bath with poor appearance characteristics as copper was increased, no loss of adhesion, good ductility properties up to about 25 mg. of copper per liter. In the alloy bath, the deposit was lustrous with a slight bluish cast at 10 mg. of copper per liter and not much change after a somewhat more pronounced bluish cast at 25 mg. of copper. No loss in adhesion was noted throughout the copper range and loss in ductility began to appear at 25-50 mg. of copper.

Other tests on the solutions were not reported, but further tests for corrosion resistance, coverage, throwing power, hardness and distribution of deposit are to be undertaken.

Project No. 6. Protective Power and Porosity of Electrodeposits. By N. Thon.

The author explained two types of electrodeposited metal coatings used to protect iron and carbon steel surface against corrosion. The first type consists of metals less anodic or less noble than iron, such as zinc; the second type is copper, nickel, tin, or metals which are more noble than iron. The first type need not be rigorously continuous, inasmuch as the galvanic couple will as a rule divert the corrosive attack thus prolonging the life of the iron.

The second type however, will act exactly the opposite and direct the anodic attack to the iron, hence, perfect continuity of coatings of the second class are necessary. That the pores of the metal deposited in the second type of coatings mentioned cause the majority of trouble was acknowledged by the author.

Most experimental methods of detection of porosity in adherent electrodeposits use reagents which bring about an observable reaction with the underlying basis metal without visible action on the deposit. One such standard method is the ferroxyl test in which a ferricyanide reagent applied to nickel, copper, tin, etc., coated on iron, produces observable Prussian-blue spots at discontinuities in the deposit. According to laboratory study by the author, it was found that this reagent definitely attacks nickel and causes perforations in the deposit. A new type of ferroxyl reagent was then investigated and it was found that high-ferricyanide, very low sodium chloride, or better, sodium sulfate reagents were, as far as corrosion of nickel is concerned, safe.

It was concluded that such tests have a definite but limited practical value in the sense that a positive reaction clearly indicates gross defects likely to result in rapid corrosion at those points. Conversely, a negative reaction only indicates freedom from gross porosity and does not in the least exclude the presence of finer or complicated pores, the harmful effect of which may well determine corrosion on long exposure.

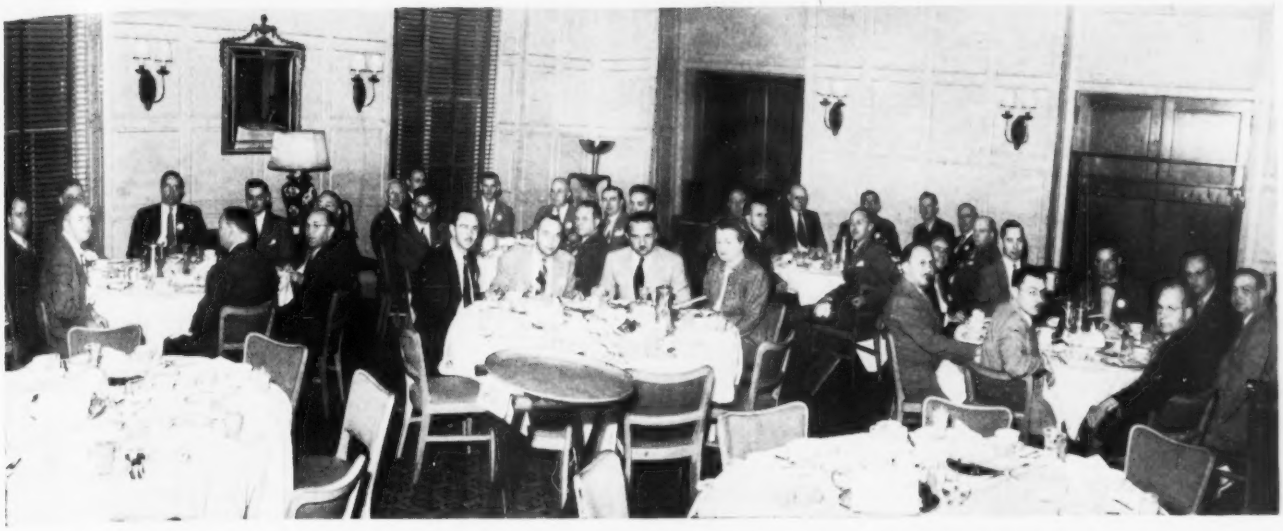
Project No. 7. Evaluation of Methods for Determining the Thickness of Electrodeposited Coatings. By Harold J. Read, Pennsylvania State College.

The method of determining the thickness of electroplated deposits were outlined by the speaker and certain types of methods were eliminated as unreliable, too expensive equipment or too cumbersome, specially constructed equipment, highly trained personnel to interpret results and applicability to a limited or unusual range of coating thicknesses. Prime consideration was given the microscopic, magnetic and chemical methods.

It was found in the microscopic method that qualified individuals obtained results which were surprisingly diverse, especially in the range of thinner deposits, (0.00063 inches). Further data is being secured by a program in progress at the present time, the specimens being prepared through to the final operations according to a set of specific directions. The data from five or six laboratories will be examined to determine whether or not the program should be continued or whether it should be modified. Variations in equipment, preparation of specimens, the fact that the method gives localized measurements and measuring techniques are some of the reasons given for the diversity of results.

In the magnetic method, the discussion was limited to consideration of the *Magne-gage*, *General Electric Thickness Gage* and the *Lipson Gage*. Virtues found in magnetic methods lie in the fact the determinations are non-destructive and that the precision of 5-10% in most cases is adequate for routine inspection purposes. Disadvantages include the inability of magnetic equipment to determine the comparative thicknesses of multiple coatings, their inability to determine thicknesses of non-magnetic deposits on non-magnetic basis metals and the fact that they are not satisfactory for either extremely thin or thick coatings.

Chemical methods are divided into two categories: the first includes methods which depend upon the total stripping of the deposit from a definite area of the work chemically, then weighing the sample before and after stripping; the second utilizes the rate of chemical reaction as the basis of



Members of the 1946-7 Research Committee and Project Directing Sub-Committees of the American Electroplaters' Society having their annual breakfast-meeting at the Statler Hotel, Detroit, on Friday morning, June 27, 1947.

measurement. The first of these methods was found to be particularly suitable for routine determinations and was stated to be the most accurate means of determining average thickness. An important factor in this case is that the density of the deposit must be accurately known; however, this is to be investigated by Project No. 9. The rate of chemical reaction methods, including jet tests, drop tests and dropping tests have the possibilities of making measurements of local thickness and they are for the most part, quite rapid and can be carried out with very simple equipment. The disadvantages include great care in calibrating the solutions; temperature of the solution, the specimen and the room; nature of deposit; skill of operator; nature of the basis metal.

The B.N.F. jet test was applied to nickel deposits to determine high internal stress effects on thickness measurements which are dependent upon the rate of chemical reaction. The author found the results inconclusive and is continuing the experiments before any definite statements can be made as to the effect of this variable. It would seem, however, that deposits from different types of solutions give different rates of chemical reactions in jet or dropping tests, and since it is well known that the internal stress is likely to be related to the type of solution used, it may well be that internal stress rather than some chemical characteristic of the deposit would lead to variable results in thickness measurement.

Project No. 8. General Consideration of Experimental Methods. By Alfred T. Ferguson, University of Michigan.

Polarization was defined as the departure of the potential of any electrode in any solution from its equilibrium value in that solution as a result of the passage of current through the electrode. Overvoltage was then defined as positive polarization. The two words, overvoltage and polarization are frequently used interchangeably. It was emphasized that overvoltage is an active potential and is in no way related to an IR drop through the solution or any kind of film on the electrode.

Several factors relating to overvoltage were given as concerned with electroplating: 1) it increases with increase in current density; 2) it increases with time; 3) is increased by colloidal addition agents; 4) is greater for complex ions; 5) decreases with increase in temperature; 6) decreases with increase in concentration; 7) is decreased by superimposing an alternating current; 8) is influenced by impurities in the electrode; 9) depends upon the kind of electrode metal; 10) depends upon physical condition of electrode metal; 11) is influenced by film formation; 12) increases throwing power; 13) is usually associated with fine grain deposits.

Various problems in polarization and overvoltage were discussed. In plating into depressions, greater polarization through the shorter paths of the solution are required to obtain results; the reverse applies to prevent the formation of elevations or excessive crystalline growth. In alloy deposition, two methods may be used for satisfactory results: ion concentration and overvoltage. Ion concentration may be reduced by tying up the metal content of the solution in a complex ion; overvoltage may be altered in several ways, the most effective being variation of current density. Without the variable factor of overvoltage, alloy deposition would be highly restricted.

In the reduction of current efficiency by the discharge of hydrogen ions, the plater can carry out some plating operations which otherwise would not be possible. Fine grain structure is also a function of overvoltage, according to the consensus of opinion.

Much confusion exists in the field of overvoltage or polarization as applied to electroplating. Methods of measurement are most often questioned and the author undertook to investigate them, concluding that the direct method of measurement of overvoltage gave entirely correct values, whereas the commutator method had inherent sources of error. The commutator method measures the potential of the electrode at the instant the main circuit is closed, then after a known interval, the circuit is opened and the potential again measured; in the direct method, measurements are made while current is flowing.

Probably the most suitable cell for every day industrial purposes in measuring polarization is the *Haring* cell.

This cell consists of an anode and cathode at the ends of the cell, between them being placed two wire gauze electrodes so spaced as to divide the whole into three chambers of equal lengths. Since the dimensions of all three compartments are the same it is only necessary to measure the potentials of each compartment to calculate the anode and cathode polarization. The voltage drop of the middle compartment is due entirely to the IR drop through the solution and the same IR exists in each of the others; if the potential of the middle is subtracted from each of the other two, the difference is the electrode polarization.

Variations of the Haring cell and other cells for determining polarization and overvoltage were described.

Project No. 9. Physical Properties of Electrodeposited Metal. By Abner Brenner and Charles W. Jennings, National Bureau of Standards.

Although Project No. 9 was set up to investigate the physical properties of electrodeposits, it was decided to restrict the first phases to the study of the physical properties of nickel, inasmuch as the field is much too broad. A literature search was made, a bibliography compiled and an abstract of the information was written, now available in the literature.

Inasmuch as the project is relatively new and no experimental data has been collected, the author reviewed information on physical properties as well as outlining plans for study of nickel deposits. Nickel deposits will be examined from solutions containing concentrations of nickel ranging from 30 to 120 g./l. The composition of the baths will range from 100% sulfate to 100% chloride with a number of intermediate mixtures; the effects of important minor additions, such as ammonium salts, iron and brighteners will be studied. The operating conditions will be as follows: temperatures ranging from room to the boiling point and current densities ranging from 1 to 50 amp./dm^2. Commercial nickel anodes and commercial chemicals will be used.

Nickel from the Watts bath has a columnar structure; bright nickel deposits have a laminated structure; grain sizes vary under varying conditions. The oxygen content of nickel deposits is of the order of a few hundredths of a percent and the hydrogen, several thousandths of a percent. The hardness of plated nickel varies from 120 to 550 Brinell, the tensile strength from 50,000 to 200,000 lb./in^2., and the elongation from 1 to 30 percent. In general, the hardness and tensile strength increases, but the ductility decreases with the addition of ammonium salts or chlorides to the bath. Raising the pH has a similar effect, while raising the temperature has the reverse.

When the hard nickel deposits are annealed, the hardness and tensile strength drops and the ductility usually increases. Annealed at 300 degrees C, the hardness will drop 100 points. The density of electrodeposited nickel is virtually the same as that of pure nickel, namely 8.9 g./cm^3. No figures are available on the endurance limit or fatigue strength of nickel coatings, nor is there information available on the electrical resistivity of electrodeposited nickel on a base metal. The magnetic permeability of nickel (as measured by its attractive force for a magnet) varies markedly with the conditions of deposition. A deposit from a Watts bath at pH of 5.6 or 5.8 has only ⅓ the magnetic permeability of nickel deposited at the recommended pH. On annealing at 400 degrees C most nickel deposits increase in permeability and come to about the same magnetic condition.

Dr. Richard M. Wick, Chairman
Fifth Educational Session

Project No. 10. Disposal of Plating Room Wastes. By Barnett F. Dodge and Dinwiddie C. Reams, Yale University.

Since active work on Project No. 10 was begun only six months ago, the project is still in the stage of surveying the literature on the subject and it will be some time before a specific research problem is chosen. Accordingly, the authors confine their discussion to a general review of the situation.

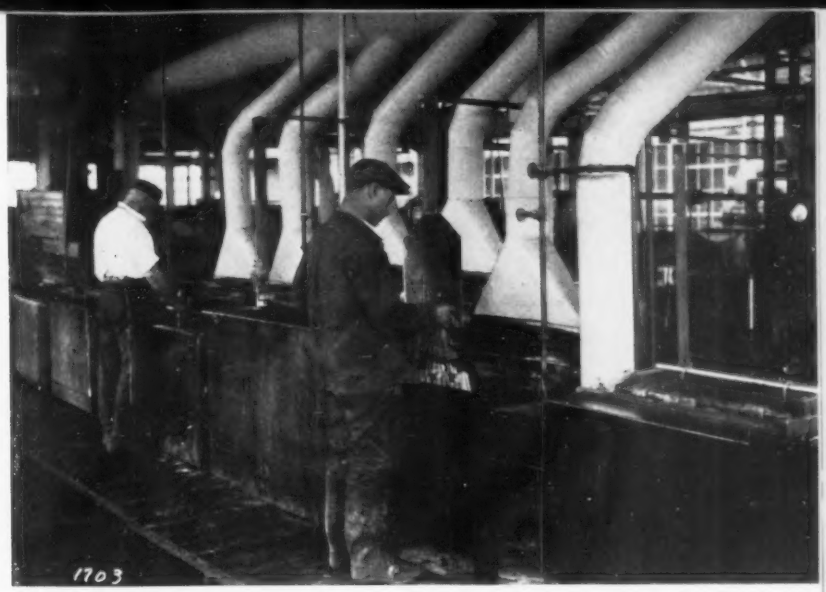
In the term "plating room wastes" the authors include not only the wastes resulting directly from the processes of electroplating but also similar wastes from other metal finishing operations, such as pickling and bright-dipping of metals, as well as anodizing of aluminum and passivating of metals. The wastes produced from the cleaning of metals by means of alkaline solutions to remove oil and grease were not considered in the paper.

The various types of wastes were reviewed and classified as follows: 1) acid wastes without chromates or cyanides; 2) chromate wastes; 3) cyanide wastes, inasmuch as the necessary treatments to produce a harmless effluent is quite different for the three classes. The volume and composition of the wastes must first be determined, as they govern the design of any treatment process; many formulas for plating, pickling, passivating and anodizing were given to illustrate the variation in composition of wastes.

It was explained that with the exception of silver and gold, disposal systems for waste in the plating plant are more economical than product recovery. Data are very incomplete on plating room wastes, although considerable work has been done on the effect of various impurities on aquatic life and on the bacteria active in sewage disposal systems. There seems to be no general agreement on the amount of impurities, particularly copper and chromate, which can be tolerated on the biological action in sewage treatment plants. To give a rough figure, it is probable that concentrations of copper or chromate of 1/10 ppm are likely to cause trouble.

Although the authors are positive that methods are already well known which will treat most metal and cyanide wastes to meet the general objective of producing an effluent that will be harmless, the methods need further development to adapt them to the needs of each plant; hence, one of the main objectives of research in the

(*Concluded on page* 103)



(Courtesy National Safety Council)

Overhead ventilation in the plating room.

Toxicity of Chemicals in Electroplating

By P. M. Van Arsdell. *Benson & Associates, Chicago 4, Ill.*

METALS and metallic salts, basic factors of electroplating processes, are being used in greater quantity and variety as a result of the expansion of the industry. They are the most poisonous materials known to man. Since the discoveries of Volta, Wollaston, Davy, and others, continued intensive research has gradually increased and widened the field in the types of solutions used and in the number of metals plated or purified by the electrolytic method.

The expansion of the industry increased the number and types of health hazards. Absorption of many of the metals is dangerous. The metallic salts present an even greater health hazard to the human organism. For example, such metals as lead, cadmium, gold, etc., are toxic when they enter the blood stream. All nitrates, sulfides, and cyanides commonly used in an electroplating bath are extremely toxic. Metals and their salts enter the body by three routes, inhalation, absorption through the skin and ingestion.

The ease with which metallic compounds enter the body depends upon their water solubility and also upon their eventual solubility in body fluids. As most electroplating depends upon the solubility of the salts, the anion generally is the determining factor. Because the cyanides, nitrates, chlorides, and certain double salts insure good solubility, they are employed in many baths. Unless great care is exercised, these may be extremely hazardous to the health, comfort, and the life of the operators as the salt concentrations are usually high, and the temperatures at which they are used range from cold to boiling.

A number of factors exist in the environs of some electroplating processes which tend to enhance the toxic reactions. These factors are dampness, heat and inadequate ventilation. All three affect the physical condition of the body, making absorption easy. Many metallic compounds show more marked toxicities for persons who are perspiring. The dampness naturally tends to hold the salts in a more active state upon the skin; inadequate ventilation causes a rise in concentration of toxic materials in the atmosphere.

There are a number of fairly typical physiological reactions to metallic salts when they are present in the working area. Metallic salts cause approximately 79 per cent of the dermatitis reactions from electroplating processes.[13] Many of these salts also cause nasal difficulties, depending upon the susceptibility of the individual, which range from simple irritations to perforation of the nasal septum as is sometimes encountered in chromium plating.[17]

The following discussion of toxic reactions to metals and metallic salts points out the particular reactions which have been reported when these compounds have been used. The metals and salts used will be given in alphabetical order and the particular bath in which they are used will also be indicated.

Aluminum and Its Salts

Aluminum salts have found application in certain types of baths, particularly the acid copper, where they are used as the sulfate.

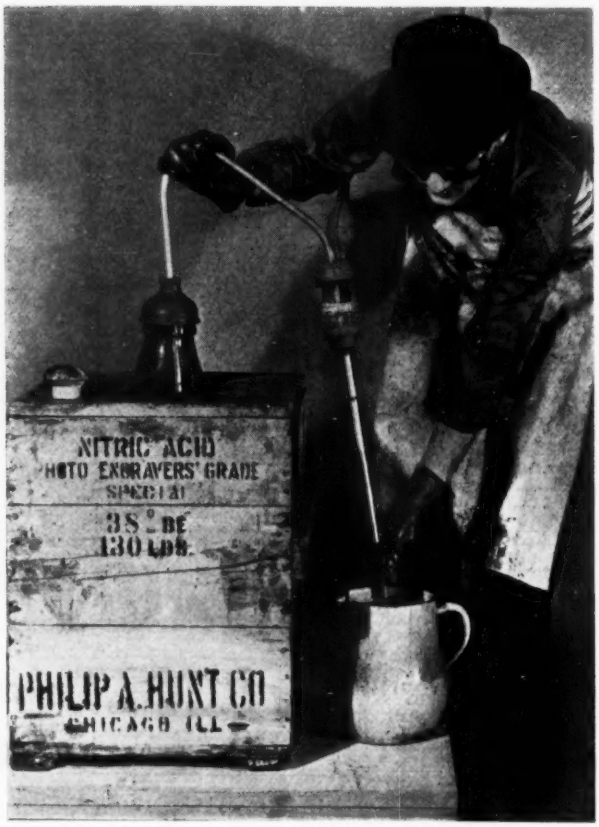
Metallic aluminum is relatively non-toxic,[10] although

certain individuals may be hypersensitive to it. The soluble salts, that is the chloride, nitrate, and sulfate may have a decidedly injurious action, particularly the chloride in dry form or in concentrated solution. This action is due to the release of acid from the molecule and the protein precipitant reaction of aluminum ions.

Inhalation of aluminum chloride, nitrate, or sulfate as sprays or vapors from concentrated solutions tend to withdraw water from the nasal, throat, and lung tissues. Acid as well as aluminum ions are liberated on the mucous tissue. The former are corrosive and irritant and the latter a protein precipitant. Should these compounds be inhaled in any quantity, the individual should be immediately removed from such atmosphere and a physician promptly called to treat the symptoms as they arise. None but professional first aid should be given. Masks and respirators should be worn to prevent respiratory contacts, particularly when dusts from these compounds are present in the working area.

Most aluminum salts in solution have an astringent effect on the skin. Should the hands be immersed in such solutions for any period a tanning reaction is apt to occur. In alum solutions, the hands receive a deposit of hydrated aluminum oxide which hardens and tans the skin leading to cracking.[64] Care must then be exercised to prevent secondary infections arising from the invasion of bacteria in the open fissures.

First aid for skin contacts depends upon the physical state of the salt—in dry form it should be wiped dry from the area with a cloth and then plenty of water flushed over the area to wash away any particles which may still adhere. For concentrated or dilute solutions, thorough water washing is sufficient to remove the material. If any reaction such as burning occurs after first aid, use soothing ointments to restore the oil to the skin. Should dermatitis develop, a physician should be consulted.



(Courtesy National Safety Council)

One of the many safe methods of transferring acids from carboys. Worker should be wearing longer gloves.

Dusts or solutions in the eyes should be removed by washing with copious amounts of water. If a burn has occurred, an eye specialist should be immediately consulted. Goggles should be worn in all atmospheres containing dusts or sprays from such compounds.

Ingestion of aluminum salts in concentrated form causes an astringent or puckering action in the mouth, stomach upset, vomiting, diarrhea, and intestinal catarrh.[8, 46, 65] Stomach washing by administration of plenty of water to prolong the vomiting reaction will relieve the body of much of the poison. Laxatives such as epsom salts in purgative doses, i.e., one tablespoonful to a glass of water, are recommended to rid the body of the poison after the stomach washing. A doctor should be consulted if untoward or prolonged symptoms persist.

Ammonium Hyroxide and Ammonium Salts

Ammonium hydroxide or ammonium salts are used in the baths for brass or bronze alloys, cadmium and also in anodizing operations.

Inhalation of ammonia fumes causes irritation of the nasal, throat and upper bronchial tracts. When a concentration as low as 0.15% is present in the atmosphere violent sneezing, lacrimation, reddening of the eyes, conjunctivitis, burning of the throat, and difficult breathing may result. The higher the concentrations, the more severe are the symptoms. When very high concentrations are inhaled, the initial shock may cause fainting and death as a consequence of the spasm of the larynx.

The gas is very destructive to mucus tissues; immediate symptoms on inhalation of medium concentrations are severe pains from mouth to stomach followed by vomiting. The lips and tongue may swell and speech be impaired; asphyxiation is steadily progressive. Even after treatment, the after effects may be hoarseness, or perhaps loss of speech which may persist for a considerable period. When ammonia gas contacts the nose and throat, boric acid should be snuffed into the nostrils and the mouth thoroughly rinsed. If possible, large amounts of ½ percent solution of citric acid or lemonade should be swallowed.[71, 2, 72]

A doctor should be consulted as soon as possible and medical treatment continued under his care. In all instances, a careful regime instituted by him should be rigidly followed. Fortunately this gas is easily detected, and its odor is familiar to almost everyone.

The following table shows the physiological effect of various concentrations.

TABLE I

PPM	*Effect*
50	Least detectable odor
698	Least amount causing eye irritation
408	Least amount causing throat irritation
1720	Least amount causing coughing
100	Maximum concentration allowable for an 8 hour day
300-500	Maximum concentration allowable for ½ hour
2500-4500	Dangerous for a short time
5000-10000	Rapidly fatal

(PPM = Parts per million)

When ammonia gas strikes the eye tissues, severe irritation results as caustic ammonium hydroxide is formed on contact with the moisture of the eyes. When high concentrations strike the eyes, the cornea may be injured followed later by loss of vision due to the infiltration of ammonia into the corneal tissues. The first aid for eye injury or contact should be flushing the eyeballs and lids with plenty of water for five minutes, then an eye wash of 4% boric acid is recommended by some to be instilled into the eye area. Certain authorities also recommend placing 2 drops of liquid petrolatum on the eyeball to decrease the burning;[71, 20] however, such measures should be left to the discretion of the physician in charge. If difficulty results and it often may, a specialist should be consulted and a history of the exposure given in order that as much discomfort as possible be avoided.

Protective measures should be adhered to at all times. Respirators or chemically approved masks and goggles should be worn when a preponderance of ammonia fumes are present.

Ammonium hydroxide acts as a caustic on skin contact and the burning effect will depend upon the individual susceptibility. Dermatitis caused by constant contact with ammonia is characterized by an unbearable itching and redness. Because of its stifling and irritating odor, it is practically impossible to swallow large amounts. Rubber gloves should be worn when using strong solutions of ammonia. If there is danger of other types of bodily contact with the caustic, additional protection should be used. The dermatitis, if not too severe, may be allayed by the use of a lanolin ointment.

When the neutral ammonium salts such as the chloride or sulfate are contacted, even in the crystalline or highly concentrated form, little or no reaction occurs. Eye contact of course should be cared for immediately by thorough washing and if any free ammonia is liberated by contact with the eye fluids, it should be treated in the same manner as outlined previously. When swallowed in large quantities these salts may cause a severe stomach upset, but there are no chronic effects as the ammonium salts are freely excreted in the urine.[65] The treatment for such an upset consists of diluting with plenty of water and the administration of a laxative. The sulfide, nitrate, or cyanide depend upon the anion for their toxic effects.

(Courtesy National Safety Council)

Special gauntlet gloves, wooden soled safety shoes and special goggles protect operator at this hand acid dipping unit.

Antimony and Its Salts

Antimony pentoxide and hydrogen chloride are used in tin stripping operations.

The salts of antimony, the chloride and oxide may cause difficulty on inhalation, although with the exception of the chloride, no cases have been reported in the literature. Antimony trichloride has been shown to cause piercing of the nasal septum.[65] This action is probably caused by the release of hydrochloric acid and metallic antimony in the nasal mucous tissue and the corrosive action caused by both elements.

A further factor to consider in toxic reaction due to the inhalation of antimony salts is the fact that vapors or dusts may lodge in the naso-pharynx, and gradually pass to the digestive tract in the exudate which is usually drained into the throat. In this entrainment it passes to the stomach giving rise to severe digestive disturbances. The diagnostic symptoms of this upset are as follows: metallic taste in the mouth, nausea, vomiting, burning heat over the body, constriction or choking in the throat, sore mouth and throat with peeling of the mucous tissue, colicky pains in the stomach and violent purging. Cramps in the legs and arms appear with cold, clammy perspiration, congestion of the head and face, weak pulse, and short painful respiration as the poisoning progresses, or depending upon the amount absorbed by inhalation. A tetanic spasm sometimes occurs, and a pustular small pox type rash may also be present.[49]

First aid must be given *promptly*. If vomiting is

not present it should be induced by mustard water or zinc sulfate emetics. Plenty of water must be given even when vomiting is present to aid the stomach in ridding itself of the poison. The patient should be kept warm and after the stomach has been thoroughly washed large amounts of strong tea or coffee may be given.[19] If these are not available, whites of eggs or barley water may be given. A doctor should be summoned, but the first aid should be given until his arrival.

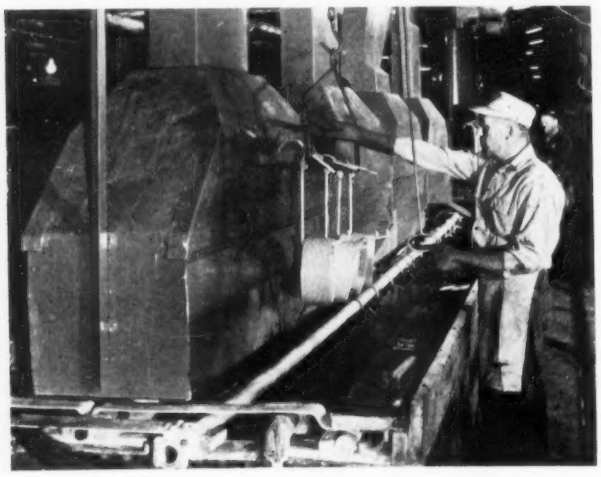
Because of the vomiting reaction, acute poisoning is rare, but smaller amounts such as those ingested from mucous entrainment may be the cause of chronic poisoning or the sub-acute type. The symptoms of this type of poisoning are weakness, general fatigue, some diarrhea, and the pustular skin eruptions.[6] Should these symptoms arise, a physician should be consulted and the history of possible contacts given. Respirators should be worn to prevent inhalation of dusts and vapors.

The chlorides of antimony on contact with the skin liberate hydrogen chloride and antimony ions. The corrosive action of hydrogen chloride produces irritation allowing for an easier absorption of free antimony which in turn produces eczematous skin eruptions resembling small-pox and leaving much the same type of scarring. Absorption of antimony into the system eventually causes generalized poisoning. Antimony metal, oxides and tartrates will also cause this type of dermatitis, but the reaction is not so acute as with the chloride.

As a first aid measure any skin contacts should be immediately cleaned with plenty of water, and if any skin breaks are present, great care should be used to make sure that no antimony compounds are absorbed by the body. Rubber gloves and aprons should be worn to prevent any contact of antimony salts either dry or in solution with the body.

Arsenic

Arsenic is used as component of the brass and bronze alloy plating bath.



(Courtesy National Safety Council)

Well ventilated plating tank. Worker's eye protection lacking.

Arsenic enters the body by inhalation, skin absorption, or ingestion.

The physiological reaction on inhalation of the inorganic arsenic compounds may consist of irritation of the nasal lining which may progress to perforation of the nasal septum. The reaction generally seems to be mildly and slowly corrosive showing lesions in the mouth lining as well as in the nasal and air passages. Eczematous eruptions may develop around the nose, mouth, and folds of skin from inhalation or contact.[53] For such symptoms, a physician should be consulted, protective mesaures however, should be the rule and the use of proper respirators mandatory.

Arsenic compounds are absorbed through the skin, the trichloride being especially dangerous in this respect, as enough can be absorbed to cause death. According to certain authorities, arsenic injuries the capillaries causing congestion which interferes with normal blood circulation, later causing clotting with a complete starvation of the tissues;[67] however, others attribute its action to that of a general cell poison which disturbs oxygen exchange, albumen absorption and carbohydrate metabolism.[55] A darkening of the skin tissues is an early symptom of arsenic absorption together with inflammation. Horny growths or tissues occurring on the palms of the hands are the first reaction; later they develop into skin tumors. When a skin reaction appears a physician should be consulted at once to institute procedures to forestall more serious difficulties; as the reaction progresses loss of hair and fingernails may also take place. Extreme care should be exercised to prevent contact with arsenic compounds by the use of protective gloves and any other means necessary to prevent skin absorption.

When arsenic compounds contact the eye tissues, general redness and conjunctivitis result.[46] According to other reports, the cornea is not injured due to the fact that no capillaries are present in the tissue. However, any symptoms should be cared for immediately upon their appearance as considerable difficulty can then be averted. Goggles as well as respirators should be worn at all times when the arsenical compounds are present.

Acute arsenical poisoning produced by swallowing causes inflammation of the digestive and intestinal tract, which is characterized by sore throat, great thirst, vomiting and profuse and painful watery diarrhea. The injury to the capillaries produced by the arsenic irritation may produce bleeding in the stomach or intestine and lead to bloody vomiting and diarrhea. The kidney tissues also become involved, the symptoms being bloody, albuminous and scanty urine. The nervous symptoms include dizziness, headache and pain in the arms and legs. Acute poisoning is shown by inflammation of the stomach and intestines which may not occur until several hours to a day after ingestion. Sub-acute poisoning is shown by inflammation of the stomach and intestines which may not be as severe as in acute poisoning. Other symptoms are inflammation of other mucous membranes appearing as conjunctivitis, nasal catarrh,

sore mouth, considerable salivation and pharyngitis. Skin eruptions may also appear if sub-acute poisoning is of long duration. Arsenic accumulates in the body tissues; thus more acute symptoms may appear as the accumulation increases.[65]

First aid for acute poisoning consists of giving emetics, washing the stomach with warm salt water, followed by castor oil or equal parts of oil and lime water to allay intestinal irritation,[49] and summoning the doctor. In the meantime the patient should be kept warm. A specific arsenic antidote has also been recommended which consists of 40 cc. of ferric sulfate diluted with 125 cc. of water to which has been added 10 grams of magnesium oxide and the entire diluted to 750 cc. The patient is given 4 oz. at a time.[65]

For the sub-acute type of poisoning, a physician should be consulted and the history of any contacts given in order that whatever reactions appear may be treated as they arise.

Boron Compounds

Boric acid and sodium perborate are used in nickel baths.

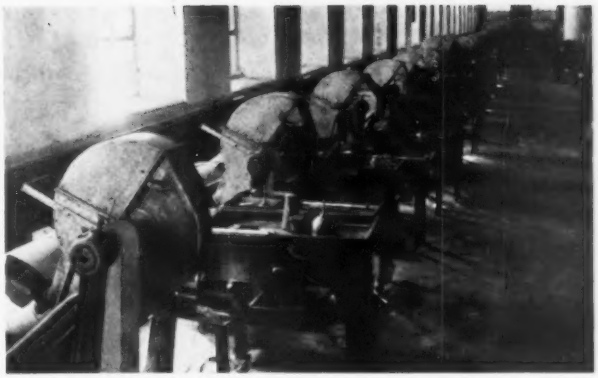
The compounds of boron, borax, boric acid and the perborates have been extensively used by the general public for many years as antiseptic eye washes and mouth washes and for cleaning wounds; however, it has not been widely recognized that there may be toxic reactions arising from contact with either intact or broken skin tissues. Boric acid diffuses to a certain extent through whole skin, but it is absorbed very readily when the epidermis is broken.[7] Treatment consists of thorough washing to remove the compounds.

Inhalation of the dry compounds might give certain drying as well as delayed toxic effects, but no instances have been recorded in the literature. Mild solutions of boric acid have been recommended as nasal washes when ammonia fumes have been inhaled without record of ill effects.[2]

Ingestion of borax or boric acid is more serious; small quantities taken over a long period or accidentally swallowed in large amounts create disturbances of the appetite, digestion and general health. The initial toxic symptoms upon ingestion of large quantities consist of dry cough, nausea, severe vomiting, diarrhea and considerable stomach irritation. As poisoning develops, irregular pulse, raised temperature, considerable redness of the body and possibly a skin eruption may appear.[35, 58] Animal tests have shown that the development of diarrhea is the initial symptom on either injection or ingestion.[35] Treatment of ingestion consists of administering copious quantities of water and inducing vomiting if it is not present. The seriousness of the reaction depends to a large extent upon the ease with which the kidneys as well as the bowels excrete the boron compounds.[7]

Cadmium and Its Salts

Cadmium plating has been used commercially since 1919. The cyanide bath in plating is used almost exclusively; however in winning cadmium from zinc ores an acid sulfate bath is used.



(Courtesy National Safety Council)

Complete guard and ventilating system on buffing wheels.

Industrially cadmium poisoning results from inhalation and not ingestion;[66] however, the use of the plated articles used in food storage or preparation has been the cause of a number of poisonings from ingestion which are worthy of mention.

The toxic reaction following the inhalation of cadmium containing vapors shows the following symptoms—a distressing cough, followed later by headache, dizziness and eventually a constricted feeling in the chest.[38] Accompanying the early symptoms are often throat dryness, and sometimes nausea, diarrhea, colic and vomiting. Chest pains which are quite severe follow the early symptoms and accompanying the pain there is also shortness of breath and difficulty in breathing. Later reactions are diffuse and patchy broncho-pneumonia which spreads and an edema which obliterates the alveolar spaces in the lungs making it impossible for the blood to receive the necessary oxygen. Generally the inhalation symptoms of cadmium poisoning are delayed for about four to eight hours. The broncho-pneumonia symptoms do not appear until twenty to thirty-six hours have elapsed and this generalized pneumonia is fatal in about fifteen per cent of the industrial cases. Death occurs between the fifth and seventh day after exposure. Recovery occurs within seven to eleven days after exposure and the chest is free from symptoms.[66] Because of the increasing use of cadmium and its salts in industry, the American Standards Association has adopted a permissible limit for working atmospheres of 1 mg. per 10 cubic meters of air.[1]

According to other reports, cadmium electroplaters also have ulcerations of the cartilage of the nasal septum as well as inflammation of the nose and pharynx which is thought to be caused by the absorption of small amounts of cadmium in the body.[59] These signs appear more frequently in the winter months than in summer and are believed to result from the lack of adequate ventilation. Respirators should be worn by all persons contacting cadmium in any form.

When inhalation symptoms occur a physician should be summoned immediately and the person removed from the contaminated atmosphere. No first aid measures are adequate and all treatment should

be directed by the doctor who has been thoroughly acquainted with the history of the exposure.

Localized skin contacts cause irritation and inflammation.[57] Rubber gloves should be worn, and constant cleanliness mandatory.

Cadmium plated articles used in food preparation or as containers for fruit juices have caused a number of outbreaks of cadmium poisoning from ingestion.[65] These symptoms appear within fifteen minutes to one hour after ingestion of the contaminated food and are ushered in by severe colic, vomiting associated with acute abdominal pains. Diarrhea commences within about fifteen minutes after the onset of vomiting, and in some cases collapse has been noted. During collapse, paleness and profuse sweating are also present. All patients exhibit some degree of shock with subnormal temperatures and thready pulse. The vomiting and diarrhea are continued at intervals and diminish after two to three hours following the ingestion. The vomiting is copious at the beginning consisting mainly of bile and mucous. The diarrhea is watery in type and the stools also contain mucous shreds. Headache and dry throat accompany the other reactions. These symptoms abate in most patients after six to eight hours, but in certain cases the diarrhea may be continued for twenty-four hours.[37]

A survey of apartment houses in one area experiencing a rather widespread outbreak of cadmium poisoning showed that about twenty-five per cent of the refrigerator trays from one manufacturer were cadmium plated. Further inquiry also revealed that refrigerator shelves and broiler grids had also been cadmium plated.[63]

First aid treatment consists of giving large quantitiess of water to insure thorough washing of the stomach until the arrival of the physician, who will then treat the case symptomatically.

As further precaution for workers in cadmium plating, *no food should be consumed or stored near the plating baths, and the hands should be thoroughly clean before any food is handled or eaten to insure that no cadmium is ingested by this means.* Acid type foods such as fruit or fruit juices are easily contaminated by very small amounts of cadmium, hence they should never be allowed to touch any article containing cadmium.

Chromium and Compounds Used in Plating

Hexavalent chromium (CrO_3) necessarily used to secure the best results in electroplating operations exhibits toxic properties on inhalation, contact, or ingestion.

Inhalation of sprays, or dusts of chromic oxide, chromic acid, or alkaline chromates or dichromates cause nasal irritation, inflammation of the nasal mucous tissues, nose bleed, and with continued exposures, perforating ulcers of the nasal septum.[13, 65, 46, 3] The throat and mouth are also affected on inhalation and the following symptoms appear progressively—many small ulcers appear on the soft palate and posterior surface of the tongue and floor of the mouth. Drying and cracking of the back of the tongue with enlargement and reddening of the buds with drying and crusting in the tonsillar region are also present after massive exposures or those of long duration.[3, 42] The earliest symptoms of chromium toxicity are sneezing, excessive secretion of tears and a profuse and watery nasal discharge. Other symptoms which may follow are labored breathing, choking sensations, dizziness, weakness and headaches. According to recommendations published in 1943 and adopted by a number of states, chromic acid or hexavalent compounds of chromium should not exceed 0.1 mg. per cubic meter of air in any working area.[12, 54, 55]

(To be continued next month)

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Cosmetic Gloves from Electroformed Molds

By Clare L. Milton, Jr., Irving Cort, Carl A. Nielson and Irving Cowan

U. S. Army Prosthetics Research Laboratory, Washington, D. C.

Electroforming of molds for the production of rubber gloves for use over articial hands is explained. The electroforming process is listed in detail, as is the novel method of forming the original model of a hand. An interesting and instructive paper of a unique application of electroforming.—Ed.

THE need for improvement in artificial limbs was brought to the focus of public attention by the 16,000 amputations performed on members of the Armed Forces as a result of the recent war. The electroplating industry can now add to its accomplishments the fact that recent developments in its field are proving of extreme importance in providing with improved prostheses not only veterans of the war but the civilian amputees who number annually several times the entire military total.

Figure 1 shows a thin, flexible, one-piece glove which is so realistic that it cannot be detected at conversational distance, yet which is rugged and longwearing, designed to cover the mechanism of a mechanical hand. The glove is an experimental product of the Army Prosthetics Research Laboratory located at the Army Medical Center, Washington, D. C. Representing a major advance in both appearance and utility, the seamless glove is now being service tested before being released for production.

Glove Mold

Electroforming provided the solution to the problem of producing a mold for the glove, a problem complicated by the wealth of surface detail so necessary to a convincing replica of a human hand and by the intricate and irregular shape of a relaxed hand. It solved the problem of economical production of a mold of high thermal conductivity, of chemical nature not harmful to the plastic employed and of sufficient strength to withstand thousands of quick heatings and coolings. The National Bureau of Standards provided the facilities with which the first molds were electroformed, and the success of this phase of the development is due to the cooperation of members of the staff of the Electrochemical Section, particularly the invaluable help so graciously given by Drs. Blum, Brenner and Lamb.

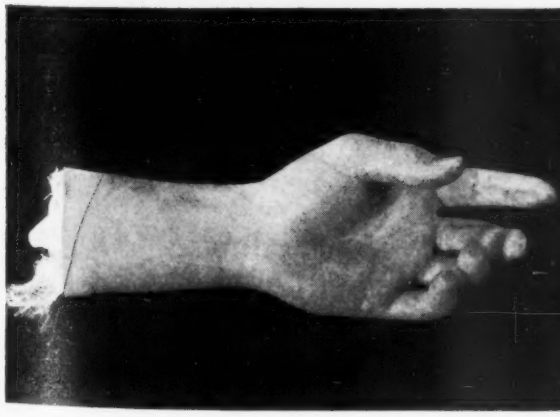

Figure 1. One-piece cosmetic glove fabricated from plasticized polyvinyl chloride in an electroformed mold. Note the excellent detail.

Figure 2. Electroformed mold for use in making rubber gloves.

Glove Material

The plastic material of which the gloves are made is a plasticized polymer based on vinyl chloride. Suitable polymers are available as prepared "plastisols" from various concerns. A special form of resin is used which can be stirred into an organic plasticizer such as dioctyl phthalate to form a somewhat fluid paste. On being heated to a temperature of 320-400°F for a few seconds and cooled, the paste is transformed to a tough sheet whose flexibility can be varied at will, from that of a rubberlike material to that of a horny solid. If the chlorine-containing plastic is held at temperatures very much above 300°F for more than a few minutes, discoloration ensues, as it does also if the plastic is heated in contact with any one of a number of metals, particularly those containing copper or zinc.

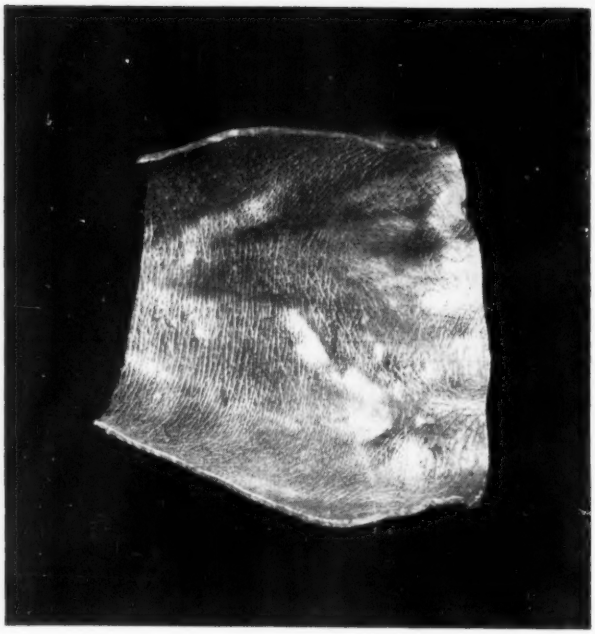

Figure 3. Interior section of a mold, showing the actual molding surface. Note the excellent detail.

Mold Material

These considerations together with the requirements of low porosity and sufficient strength to resist handling, prohibit the successful use of plaster or rubber molds, which exhibit poor thermal conductivities and cannot withstand the elevated temperatures employed. Castings of bismuth-base alloys do not successfully resist distortion on repeated heating and cooling and are not sufficiently strong when thin walls are employed, while copper and zinc base alloy castings are eliminated from consideration because they accelerate the decomposition and discoloration of the plastic. Major technical difficulties stand in the way of casting molds of the required precision and intricacy of detail in the high melting nickel or stainless alloys which would be required.

Electroforming Process

Electroforming with nickel, frequently regarded as an expensive last resort, became the most economical means of constructing the molds. Because of the peculiar problems involved in forming a piece of the shape required, what are believed to be novel solutions were worked out and may prove of value in other applications. Figure 2 shows the outside of a completed mold which is open at the wrist, while Figure 3 is a cutaway exposing the detail of the interior, which is the actual molding surface. Since the gloves are hollow and not rigid a seamless, single piece mold can be used.

The heart of the process of making this mold is the use made of a hollow, seamless, flexible, plastic replica of the glove to be produced. Instead of conducting the electroforming over a model of some low melting alloy which would be difficult to cast with the desired detail and hard to separate cleanly from the nickel, use is made of a plastic form which can be pulled out of the finished cavity. Rubber forms are much less suitable because of the shrinkage which occurs when films are deposited from a latex. Plaster models are avoided because of the more complicated process involved first in sealing the pores and finally in removing the gypsum from the completed mold and also because the finger positions of plastic models can be adjusted, possibilities which do not exist when plaster or metal is used.

Forming Model of Hand

A novel method of constructing this complicated model was developed. It consists in taking an impression of a hand selected for size, shape, age, sex, etc., in an alginate material familiar to dentists. On mixing a prepared powder with water containing a little phosphate, a slurry is obtained. Within about four minutes the slurry sets to a semi-rigid jelly from which the arm is withdrawn leaving a cavity. This impression may be heated in water to 85°C without distortion or loss of detail. At this temperature the cavity is drained and into it is poured a vinyl resin paste similar to that from which the actual gloves are made. Within a few seconds a layer of paste gels against the surface of the impression and the excess is poured out. After further heating to strengthen the thin layer of plastic a mixture of sand and wax is poured inside and the whole allowed to cool as soon as one end of a copper or brass strip has been thrust down into the hot wax.

Removal of the impression material reveals a replica hand, composed of a rubberlike skin of plastic held rigid by a fusible sand-wax core, with an electrode projecting from the wrist. It remains to make the replica conducting and to electroform over it.

Generating Conducting Film

In early experiments the replica was silvered by immersion, using the Brashear formula.* This method has proved superior to the use of graphite or silver lacquer. For reasons of economy, spray silvering was later adopted. At first, difficulties were encountered because of the intensely hydrophobic nature of the plastic surface. These were overcome by sensitizing in alcoholic rather than acqueous stannous chloride solution, at the suggestion of Messrs. Buck and Gosnell of the Government Printing Office, and by spraying an alcoholic solution of formaldehyde in place of the customary acqueous solution. Hydrazine sulfate may be employed as the reducing agent in place of formaldehyde or the hydrolyzed sucrose solution of the Brashear formula. In this case the addition of a wetting agent to both reducing and silver solutions is recommended. Prior to being sensitized, the replica is boiled for a few minutes in an alkaline cleaning solution and rinsed.

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* Circular of the National Bureau of Standards, No. 389, January 6, 1931, "The Making of Mirrors by the Deposition of Metal on Glass."

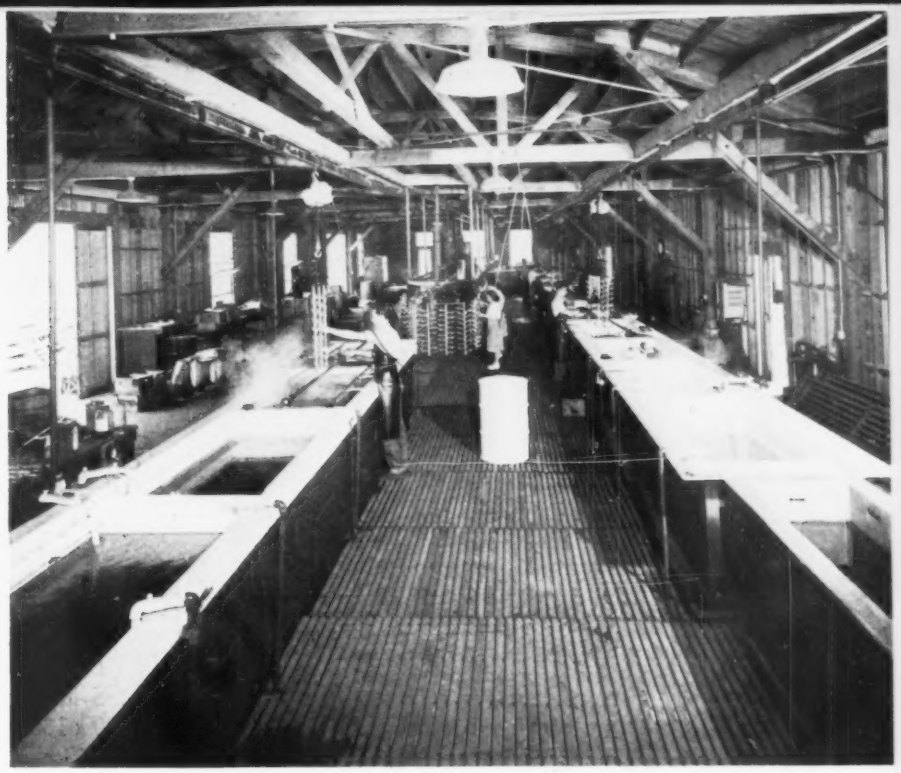

Figure 1. Interior view of the 45 x 145 foot plating department, showing the 185-foot U-shaped, semi-automatic plating installation. Self-designed and built by the owner, the installation contains 23 tanks and operates on three cycles for electroplating aluminum, plating brass and zinc plumbing parts.

Aluminum Electropolishing Plant

By Fred A. Herr, *Los Angeles, Calif.*

INDICATIVE of the tremendous growth during the past half dozen years in nearly every phase of the metal and organic finishing fields in Southern California is the new half million dollar plant of Automatic Polishers operated at 1821 Randolph St., Los Angeles.

Expanded to its present size since the close of the war, this establishment, which is devoted primarily to the manufacture, plating and polishing of plumbing parts, is claimed to be the only complete plant in the United States for electropolishng aluminum die castings.

When the close of the war left the owner free to resume manufacturing unhampered by governmental regulations, he began planning an expanded postwar setup that would enable him not only to handle all operations pertaining to the production and processing of plumbing parts in one plant, but would also make it possible to produce his own die castings and finish them in a completely equipped electropolishing department.

Cognizant of the fact that in the entire United States there existed no complete plant for electropolishing aluminum die castings, the owner determined to develop one himself. The postwar plant was envisaged as a complete establishment for processing plumbing parts so that no phase of the operations would have to be sub-let to outside shops. To that end three major buildings were taken over and which have been converted into three production departments equipped to process aluminum by both the automatic and electrolytic polishing methods. Started in the summer of 1945 shortly after the war ended, the expansion project was completed late in 1946.

The plant now is housed in a series of one-story buildings adjoining one another along the north side of the street. The rather small and unimpressive exteriors serve as the facade for one of the largest and most efficiently equipped plating and polishing establishments on the West Coast. The major production buildings include a die cast building, a plating building and a polishing building, between which nestles a one-story brick-front office building.

The structure housing the plating department is of one-story height and measures 45 feet in width by 145 feet in length. Building and equipment cost an estimated $150,000. It is equipped with a semi-automatic plating installation, designed and constructed by the owner. The setup has cycles for plating aluminum, brass and zinc. Principal pieces of work handled in it are plumbing parts, such as valves, spigots, nuts, spigot nuts, die castings, extrusion castings, sand castings and stampings.

The entire unit is 185 feet long and contains 23 tanks. The tanks are all plus size, the main plating vats measuring 4 x 6 x 12 feet and capable of accommodating a 6 foot shower curtain rod. The installation is set up in a U-shaped arrangement. The long arm of the unit follows the 145 foot length of

Figure 2. General view of exterior of one of the most modernly equipped plating, polishing and die cast plants on the Pacific Coast, completely equipped for electropolishing aluminum die castings.

the shop and bears at right-angles at either end to form a flat "U." Rails for a traveling crane with which large single pieces and racks filled with small plumbing parts are lifted into and out of the successive tanks, are mounted just below the ceiling joists, above each arm of the U-shaped tank setup.

The plating foreman explained to *Metal Finishing* that shop practice is to send the work through the regular cleaning cycle with conventional procedure. A copper flash is then applied, followed by a heavy copper plate, after which the copper plate is electropolished in a phosphoric acid bath at 200 amperes per square foot.

The hundreds of thousands of various sized plumbing parts (from a tiny spigot nut to a 6-foot shower pole) that pass through the plant weekly made necessary a huge polishing department. These facilities are housed in a separate building which is devoted entirely to polishing operations. The building parallels the plating building and measures 45 x 100 feet. The chief pieces of equipment consist of four rotary automatic polishing units and a straight-line polishing machine with eight heads. Cost of this building, including equipment, was estimated at $100,000.

Largest of the three production buildings is the one housing the die cast department. It measures 100 x 150 feet and is equipped with the most modern facilities and presses for producing die castings for the plumbing parts the firm manufactures and distributes nationally. This department was built and equipped at a total cost of $250,000. A 25 x 30 foot room, walled off from the main die cast plant, is equipped with six tumbling barrels.

COSMETIC GLOVES

(*Concluded from page* 62)

Plating of Model

Nickel plating is done in a Watts type bath. 0.003 to 0.005 inches of nickel are deposited, then reinforced with approximately 0.025 to 0.030 inches of copper from an acid copper bath. Approximately 0.001 inches nickel is deposited over the copper to protect it from corrosion. A sandwich structure consisting of alternate layers of nickel and copper has also been used successfully.

Separation of the plastic replica from the negative mold is accomplished by melting out the filler and pulling out the glove by hand, with the assistance of a blast of air.

Operating Difficulties

Most of the difficulties encountered in the plating are due to the relaxed position of the replica. Among these difficulties were the following:

1. Build-up around fingertips: While the average current density employed in the copper bath is around $1.0 \frac{\text{amp}}{\text{dm}^2}$, in the absence of special precautions the current density is probably five to ten times greater at the fingertips and nails. To eliminate excessive buildup of metal at these points a metallic thief, about 1½ inches wide is placed so as to follow the outline of the fingertips at a distance from them of approximately ½ inch and connected to the cathode bar. By this device unwanted build-up is repressed successfully.

2. Throwing Power: Since the palm of a hand is shielded by the fingers, the metal deposited in this section would ordinarily be much thinner than, for example, that on the back of the hand. An internal anode, in the form of a lead ball, placed approximately one inch from the surface of the palm and connected to a separate circuit, counteracts the effect of the shielding and builds up the deposit in this area.

3. Method of Holding Positive in Bath and Making Contact: Since the specific gravity of a plastic replica, before any metal is plated, is less than that of the plating solutions used, the positive would float unless it were securely bound to the cathode bar. Considerable difficulty was at first encountered in conducting the current to the silvered surface. To eliminate this a copper or brass strip is cast into the filler as described above. The end of the strip is bent to fit the cathode bar. Silver is sprayed around the contact between the strip and the surface of the positive. This strip then serves as a hanger and conductor of current from the cathode bar to the silvered plastic surface.

Conclusion

Molds made by the method described above are being successfully used in the fabrication of lifelike cosmetic gloves. While developed specifically for this purpose, the process should be capable of being adapted easily to the construction of complicated molds for other purposes.

Profits After Taxes, If Any

By Flory Monacell, *Tax Counsel, Los Angeles, Calif.*

NOW that the shadows of the latest war have gradually faded so completely that any war talk is about the next one, business leaders in the metal finishing industry are as interested as any other leaders in more profits and better relations with the government. There can be little doubt but that taxes bring us closer to the government than any other factor.

The Department

The Treasury Department of our federal government, known to tax experts as "The Department," has been very businesslike in its interpretation and explanation of revenue laws in spite of the political ambiguity sometimes attendant thereto. No one can make a study of the Internal Revenue Code and thereafter say that it is not in keeping with the most standardized and most conservative accounting practices in the American mind. When the Department practically orders the taxpayer to price inventories at cost or market, whichever is lower, he can rest assured that it wants no more of his money than is due.

In trying to establish better relations with the Department the taxpayer's first step is to find out "what has gone on before." The need at this point is for expert tax counsel to find out the real law that the Department is holding over the taxpayer's head, be he little or big. The entire tax structure flows with the principle that whenever the taxpayer is asked to report income, he is automatically allowed to deduct ordinary business expenses in obtaining that income. The word "ordinary" is defined to mean as customary and usual and in line with common practice. As an example, the Department would probably not allow an item of traveling expenses of $4,000 for a druggist whose sales were only $11,000 and most of whose customers come right into his establishment, which is located in a town of 7,000 people. This particular druggist may well have spent $4,000 for expenses for the year but probably for other items. After all, the Department has only the return to work on and you cannot expect it to appear undisturbed. The Department wants to collect all the taxes it can and will interpret the law not for total immediate relief but for continued taxes from the same taxpayer. It by no means can afford to run a man out of business, but would prevent killing the goose that laid the golden egg. Nothing succeeds like success and Uncle Sam knows that.

Contributions

Not many realize that when the government says the taxpayer may contribute up to fifteen per cent of his income, he may give to non-profit schools. There are a great many well-deserving such schools in the vicinity of each taxpayer which are training, as best they can, students who will go into plants well-trained, saving the costly program of educating them.

Many of these trade schools, colleges, universities, private schools, etc., are already doing a fine job, and are training a large number of veterans, but everyone knows that all schools work under a financial handicap. Uncle Sam would surely not object to any aid going to these schools. Although the schools are begging to obtain relief, they are too proud to come right out and say so. Professionally, also, they do not feel able to seek financial aid, since the means of repayment by ordinary means are so indefinite.

Supply Expense

There are many items of supplies in the metal finishing business which are used up a lot more quickly than in other fields. In most plants the item of supplies is and should be a small item. If an audit were to be made of most any concern and an item of over one hundred dollars is seen as a single entry, an investigation would be in order. But in the metal finishing trade a majority if not all of the materials purchases are actually supplies, and are used up quite quickly, thereby giving a very large percentage of "supply expense" that may be charged off. As much of the quantity of supply is used, inventories are always low and should be kept low unless we can make a good buy of some items which are hard to get. There has not been any test case as yet, but it is certain that in the courts, black market prices for supplies will hardly be honored where discernible. It is, therefore, not recommended that enormous prices be paid in the black market in the hope that income tax expense deductions can thereby be raised, to result in a smaller taxable net income. Deduction credit cannot be claimed for anything which in itself is illegal, so it behooves the taxpayer to be within the law at all times.

Some taxpayers do not have enough insurance on their business. Some carry only fire insurance as if that is the only risk there is. The Department very

seldom questions the insurance expense of most tax returns, and itself has often remarked how surprisingly low the deductions are for insurance on most returns. Here, together with the contributions to trade schools teaching metal finishing, are two or the many items which can be built up by actual expenditures without attracting the ire of Uncle Sam. No one can deny the value of insurance, and no one can find an item which cannot be insured. Lloyds of London is only one of many insurance companies which will insure almost everything from your car to your voice.

Reporting Income

One thing to be remembered is that the Department does want us to report all our income, regardless of how many deductions we may have against it. On this point it is very strict and starts out its forms with this item. The tax is actually and originally one against income, but in practice it has really turned out to be a profits tax. In the individual income tax returns, however, it remains still an income tax, except for such items as gains and losses on short and long term investments.

Although income is wanted reported, every bank deposit is not necessarily income. If detail books or records are not kept some taxpayers use the total of their deposits as income and total checks as expenditures, not realizing that there might be some deposits which are not income in the sense of the tax law. Many checks, even if written on business check forms, may be for personal, non-deductible items. A case in point. In an investigation of a large construction firm an item was found among the deposits for the same amount as one of the checks written on the same day. It was found out that the company had made out a check to a school for the son of a member of the firm, and the member had, out of his own pocket, deposited a like amount to cover the check. Obviously, this particular deposit cannot be called income of the firm. It was simple to spot this odd deposit, but a great many other similar and combined deposits which for obscurity must go unnoticed.

Deductions

To turn to the deduction side of the ledger, notice should be taken of one particular item which may not mean so much in dollars and cents to some, but does amount to a lot to others. This is the manner of treating the purchase of equipment and inventory items. Nowadays taxpayers find a sales tax, among other taxes, not to mention freight charges, etc., added on to the actual cost of the piece of equipment or item of merchandise. In entering the purchase it is important to break up the invoice into equipment purchases of inventory items, freight, drayage, sales tax, excise tax, transportation tax, interest, storage, commissions, and a host of other charges which are so often added to invoices. In separating them, equipment costs can be kept down since only a fair depreciation on equipments are deductible each year and inventory figures as high merchandise and supply purchases, not only give the wrong cost of these items, but do not allow a proper loss to be taken on lower inventory values at the end of the taxable year. Many times The Department has criticized taxpayers for unusually large merchandise and supply costs, when in reality a large proportion is made up of freight, drayage, etc.

Bookkeeping

Wherever inventories are involved the taxpayer must of necessity keep his books on an accrual basis, which in the final analysis is the only way to keep accounting records accurately. What good are a set of books unless they are as accurate as possible? Those in the metal finishing industry know how soon they can go into the red unless they know their costs. It is most difficult to keep a set of accurate cost records on a cash basis.

Many are of the opinion that once an income tax report is sent in, nothing can be done with it by ourselves. Nothing is further from the truth. Uncle Sam can review a return for three years after it is made out, and even longer in some cases, especially where fraud is reasonably suspected. If the due date is at hand, a return can be hastily made out and sent in along with the proper payment. No matter how hastily or how carefully a return is made out one should have it reviewed several times by a tax expert.

Not so long ago a taxpayer had someone help him with his 1945 federal return and had reported a taxable income of about $8,000 from a gross receipts of about $16,000. He was in the metal coating business and he actually believed that the return was correct, so that he was happy to pay the government the enormous tax on half his gross receipts. Although he did not want to engage counsel to review the return, he was sure that The Department will itself discover some obvious errors in his return and force him to give it a review. He admitted that he hardly had the cash to pay the tax but simultaneously agreed that he probably had profited to the tune of $8,000. It doesn't make sense.

A taxpayer had spent all the money he could get his hands on in 1946 in purchasing hard-to-get merchandise so that in January at the time for a tax remittance he had to floor some of his materials to get the cash to pay the tax. His books showed a lot of taxable income, but a determined lack of ready cash to make any tax payment. True, he could divide his payments quarterly, but to him even that sum was staggering, since he can hardly write out a check without first checking his bank balance. Not only that, but his book bank balance is very often in the red.

Department Routine

One thing about The Department that is not generally known is that all the people in it are not necessarily experts. Many are new and many have so many chores that they cannot know all the details of all the revenue laws. Recently a tax counsel needed some

advice on a certain item and he spent a full morning on the phone calling just about everyone in a local office of the Department and also the district office. Finally he contacted an old-timer and got his information in two seconds.

Many of the present tax laws lie not in the internal revenue code but in the decisions of tax cases which have come up in the past. This we call "precedent" and truly becomes a most important part of the tax set-up. This is chiefly important for items on which the internal revenue code is not very explicit. We refer to such unexplained items as business expense, ordinary income and the like. Many cases have come up where a taxpayer claims an item to be a business expense which the collector of internal revenue may not allow without a fight. Although in some cases the law tries to be very explicit, still these items come up, not once a year, but every day in the year; so often that the "Tax Court" set up for this very purpose is one of the busiest in the land.

If the internal revenue officer should wish to make an audit, be as courteous to him as you can. Try your best to get the auditor or accountant of your firm to assist the gentlemen as much as possible. As a general rule he will have all his proper credentials with him, as not a case is known where someone was accused of impersonating an internal revenue man. Have the books in good order and do not hesitate to give the man access to them and the copies of past returns, together with copies of supporting invoices, etc.

Conclusion

As a general rule, if you have run your business on a conservative basis, there should be enough cash in the bank at the end of the year to pay the proper income taxes that are payable. Unless considerable funds have been diverted to equipment, inventories, etc., any situation in which a proper tax cannot be paid should be investigated. Some error may be found in the accounting and another audit may be advisable. Besides being accurate, the books should make sense. If the firm has had a great loss or a great gain in the past year, then it should show in lower or higher values in assets or dividends or drawings. And believe it or not and contrary to common opinion, income tax returns really do make sense, especially to those who understand them.

In three cases out of every four in the past year it has been more profitable to make separate returns for husband and wife, especially where there is a high income and where the wife is an income producer.

Although most executives in the metal finishing industry will be wise enough to engage counsel in tax matters, one should not hesitate to cross bats with the counsel at any time it is felt something is wrong with the tax return. Although a person may be an expert on tax matters, it is entirely possible that he may not be entirely familiar with your particular set-up. No matter how settled tax laws and tax case precedents are, there is always possibility of new situations arising.

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79. Zvaifler, *J. Ind. Hyg. & Tox. 26* 124 (1944).

Surface Texture Study of Electroplated Zinc

By R. L. Lunt, *Valencia, Penna.*

A microphotographic study of electroplated surface textures is presented in this paper. The factors which influence surface texture and smoothness on strip and sheet steel are given. The work represents an investigation of zinc and zinc-alloy plating from acid baths.—Ed.

All photographs by George Knight, laboratory assistant.

Figure 1. About natural size. Structure of a cast zinc anode (99.99%) of the type used in these determinations in the laboratory. It is also of the same size and type that is used in a large 11,000 gallon electroplating tank where 24 traveling steel strips are simultaneously plated with zinc by one of the oldest continuous plating equipments in the country. In spite of the fact that there is no agitation of electrolyte as compared with the violent agitation which was used in the laboratory in these experiments, the texture of the traveling steel strips as shown in Figure 7 have almost as fine a surface texture as that shown in Figure 4, which shows the condition produced by a rapidly moving zinc anode of the same type, accompanied by violent agitation. The crystalline internal structure of this type of cast steel anode is plainly shown in this photograph.

THE microphotographs accompanying this paper were made at 200 magnification rather than at lower powers, as is usual in studying surface textures. The exposure was instantaneous under intense light striking the surface at a small angle in order to accentuate roughness in texture. The determinations were made in such a manner that nothing was changed in the equipment except the anodes and their relative movement with regard to the cathodes. In all cases the cathodes were of strip steel.

From these experiments, it may be concluded that the internal crystal or grain structure of the anode has a direct influence upon the surface texture of the deposit and that the resultant surface texture is not a function of the cathode surface texture alone. The point is made that a mirror surface texture of the

Fig. 2. Showing the surface texture of zinc plated by stationary anode on mill run cold rolled steel. In order to show that the surface of the cathode is not responsible for the resultant surface texture of the cathode, zinc from an acid solution with a stationary anode was plated upon the mirror surface of a steel sheet produced by means of tungsten carbide rolls. Figure 5 shows the surface texture obtained when this was done; there is no apparent difference between the two surface textures. All conditions were exactly the same so that the result can be attributed to the internal structure of the cast zinc anode.

cathode will not necessarily cause such a mirror surface to be reproduced by electroplating in acid zinc solutions unless certain other conditions are met.

The microphotographs show that not only the internal structure of the anode, but the fact that it is either stationary or in motion has a pronounced effect upon the surface texture of the cathode deposit in acid-zinc electrolytes. There is no doubt but that agitation is of vital benefit to all plating cycles, but it should be pointed out that agitation alone improves surface texture in acid-zinc solutions.

It may be seen from the following pictures that uniform distribution of the lines of electrolytic action are largely responsible for fine textured surfaces. Where the lines cannot be uniform in density, the same effect may be produced by relative movement between anode and cathode.

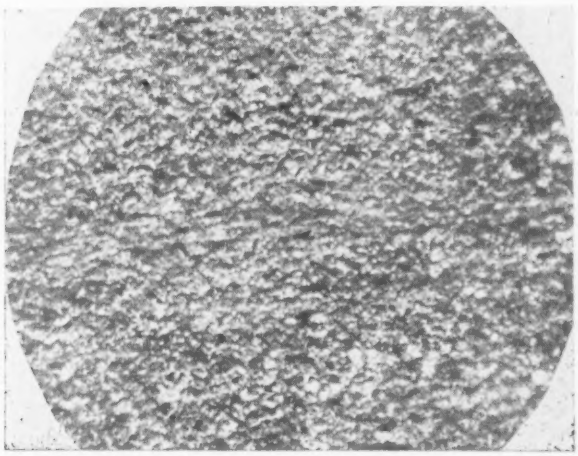


Figure 3. Surface texture which was obtained when a stationary graphite anode of exactly the same size and shape as that shown in Figure 1 was substituted for the cast zinc anode. Compare the surface texture of this specimen with those of Figures 2 and 5, where the zinc anode was used. It can be seen that the rougher texture produced by the use of the zinc anode was caused by a non-uniform distribution of the lines of electrolytic action and that the unequal distribution had its origin in the crystalline structure of the cast zinc anode. The graphite anode being homogeneous in internal structure and in electrical resistance, produced a field of uniform density all over the cathode surface.

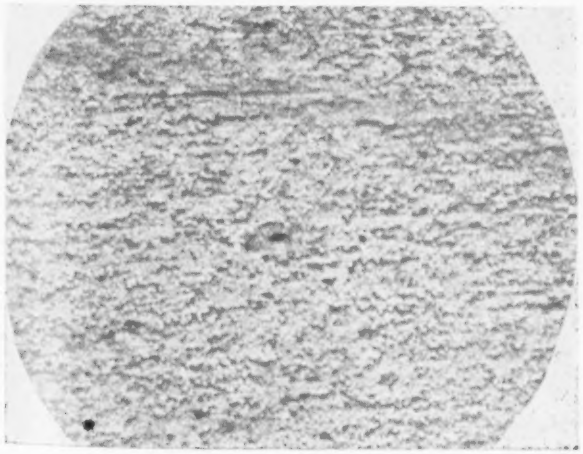


Figure 4. Showing surface texture produced by rapid movement of the zinc anode across the steel strip with consequent agitation of the electrolyte. Such relative movement of anode and cathode can be said to produce the effect of uniform distribution of lines of electrolytic action, resulting in a smooth surface. Compare all moving-anode surfaces, as shown in Figures 4, 6 and 7, with those using stationary anodes.

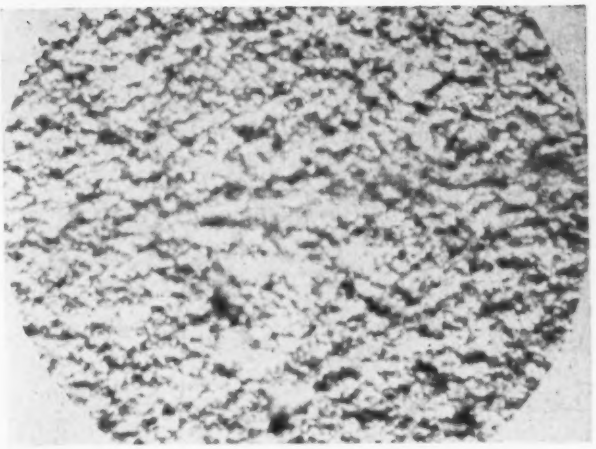


Figure 5. Effect of a stationary zinc anode when it is used to plate a sheet of mirror finished steel. Note that there is little or no difference in the surface texture on this fine grade of steel from that of the stationary zinc anode on mill run steel. When however, the anode is set in motion, a much smoother surface is obtained, as shown in Figure 6.

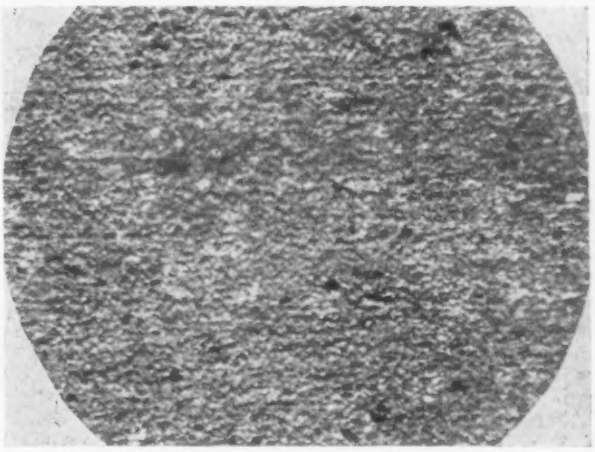


Figure 6. Surface texture produced when the same zinc anode that was used in Figure 5 was set in motion across the steel cathode, which in this case was also mirror finished steel.

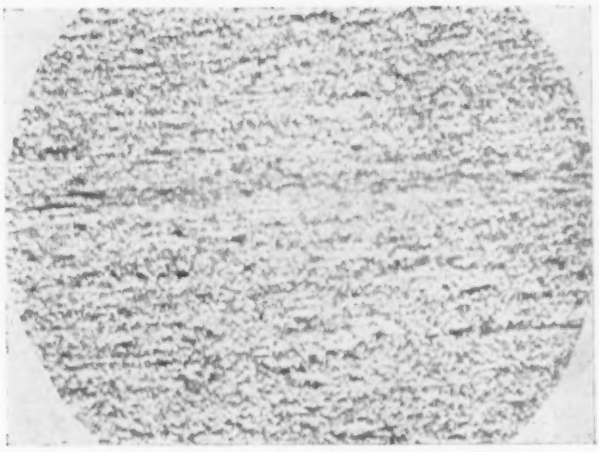


Figure 7. Showing surface texture of a moving strip zinc plated in acid solution. Here the cathode or strip was moving and the anodes stationary. The strip was plated in a large production line, where relative movement of the solution is not very rapid, hence the surface condition is not as good as that shown in Figure 4. It may be concluded that within limits, the rapidity of movement has an influence upon the cathode surface texture.

Patents

Electrolytic Cleaning Process

U. S. Pat. 2,420,602. *Richard W. Kingerley, Jr., assignor to E. I. du Pont de Nemours & Company, May* 13, 1947.

In a process for the removal of mineral oil from a ferrous metal following cold-rolling of the metal using the oil as a lubricant the step comprising electrocleaning the metal in a silicate detergent solution comprising essentially a sodium silicate having an SiO_2/Na_2O weight ratio from about 1.9 to 2.4, the weight ratio of total SiO_2 to total Na_2O in the solution also being in the range from 1.9 to 2.4.

Copper Plating on Wire

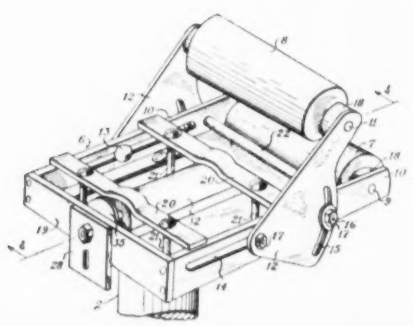
U. S. Pat. 2,420,291. *Orville E. Adler, assignor to National-Standard Company, May* 13, 1947.

The method of forming a copper clad wire which comprises cleaning a ferrous wire in a hot clean bath of hydrochloric acid having a concentration not substantially less than 20% to produce a silvery white crystalline appearing surface, electro-depositing upon such surface from the cyanide bath a firmly adherent layer of copper, and electro-depositing upon the cyanide copper a firmly adherent layer of copper from an acid bath.

Polishing Machine Work Holder

U. S. Patent 2,422,430. *James J. Manderscheid, John Ratkovich and Vincent Kovacic, assignors to the Manderscheid Company, June* 17, 1947.

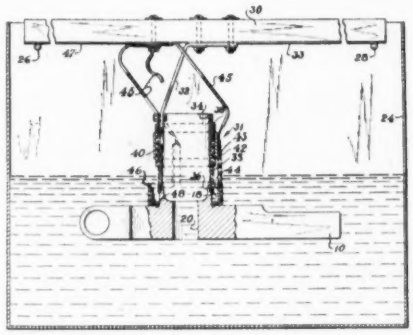
Mechanism for mounting and retaining a tube or rod during a polishing operation, comprising a portable machine adapted to be readily moved into position adjacent a polishing wheel and including an adjustable frame, a pair of rolls freely rotatable on the frame, means for adjusting one of said rolls with respect to the other to mount and retain tubes or rods of different cross-sections therebetween during the polishing operation, means for tensionally retaining the frame and rolls in adjusted position, and means for releasing the tension whereby to cause retraction of the frame and rolls.



Electroplating Fixture

U. S. Patent 2,422,242. *Morton Kaufman, assignor to Wright Aeronautical Corporation, June* 17, 1947

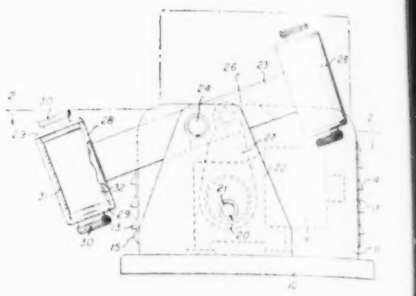
An electroplating fixture for plating a circumscribing band-like area on the surface of an object disposed in a suitable electrolyte, sajd fixture comprising tubular shield means adapted to embrace said object adjacent to one edge of said band-like area, a tubular anode member supported from said shield means and arranged to be disposed in said electrolyte so as to surround said band-like area in spaced relation thereto, shield means embracing the surface of said anode member remote from said band-like area, said shield means having a portion extending inwardly from one edge of said anode member and terminating adjacent to the other edge of said band-like area.



Small Part Burring Shaker

U. S. Patent 2,423,019. *David T. Haines, Sr., June* 24, 1947.

A machine of the kind described, comprising a vertically movable rocking beam, barrel-like containers at opposite ends of the beam and having abrasive linings thereto, said containers being internally threaded at each end thereof, screw threaded removable ends on the containers, knurled knobs on said ends for the removal thereof and power means for imparting rocking movement to the beam.



Metal Coating Non-Conductors

U. S. Pat. 2,421,079. *Harold Narcus, May* 27, 1947

A method of metal coating the surface of a non-conductive material which comprises roughening said surface, cleaning the surface to remove foreign substances, immersing same in the following solution for a period of ½-1 minute:

Stannous fluoborate	grams	15-20
Fluoboric acid (42%)	c. c.	250
Sodium chloride	grams	75-100
Water	c. c.	1000

to cause the surface to be receptive to the formation of a subsequent conductive layer, thoroughly washing the same to remove excess of the solution and then treating the properly washed material in any of the usually employed silvering solutions.

Abrasive Material

U. S. Pat. 2,422,153. *Garret Van Nimwegen, Carl von Doenhoff, and Charles E. Wooddell, assignors to The Carborundum Company, June* 10, 1947

An ebonite cured composition comprising the reaction product of a copolymer of butadiene and styrene, sulfur in sufficient amount to vulcanize said copolymer to the ebonite state, a fatty acid, boric oxide in an amount from 0.1 to 15% by weight of copolymer, and a non-reactive filler in a proportion by volume with respect to said copolymer of from 1:1 to 4.1:1.

Abrasive Blasting

U. S. Pat. 2,421,849. *Percy J. Potter, assignor to Pangborn Corporation, June* 10, 1947

A method of abrasive blasting which comprises burning a gas generating propellant in a confined space containing abrasive particles and having

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an orifice, permitting the expanding gases to escape from said confined space through said orifice as a forceful jet containing said abrasive particles, and utilizing said particles to blast an object.

End Brush

U. S. Pat. 2,421,647. *Ruben O. Peterson, assignor to The Osborn Manufacturing Company, June* 3, 1947

As a new article of manufacture, an end brush component comprising a cup-shaped base, a bundle of brush material, arranged in substantial parallelism, secured at one end in said base, the outer edge of the latter being turned inwardly, and a removable bridle enclosing the portion of such bundle adjacent said base and constituting a rigid support for such portion said bridle being formed to slightly overlap such inturned edge of said base.

Zinc Plating Bath

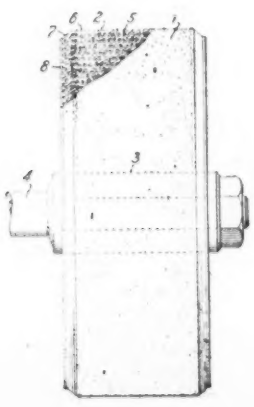
U. S. Pat. 2,421,265. *George B. Hogaboom, assignor to Hanson-Van Winkle-Munning Co., May* 27, 1947

An aqueous bath for the electrodeposition of zinc, comprising zinc chloride and zinc acetate as substantially the entire electrolyte, the total zinc being within the range of 10 to 30 oz./gal. with about 80% supplied from zinc chloride and about 20% from zinc acetate.

Laminated Abrasive Tool

U. S. Patent 2,422,876. *George W. Allred, June* 24, 1947.

An abrasive tool comprising a plurality of superposed layers of sheet material each layer comprising a portion coated with abrasive and uncoated portions, said uncoated portions being folded between adjacent layers of said coated portions and said layers being secured together by adhesive attachment between uncoated surfaces thereof.



Iron and Aluminum Degreasing

U. S. Patent 2,422,556. *Walter Klabunde, assignor to E. I. du Pont de Nemours & Company, June* 17, 1947.

A solvent adapted for degreasing iron and aluminum comprising trichlorethylene containing, as a stabilizer against condensation reactions of trichlorethylene catalyzed by the aforesaid metals, 0.02 to 1% by weight of vinyl cyanide.

Anti-Rust Composition

U. S. Pat. 2,421,672. *Chester E. Wilson and Mary Louise Dodge, assignors to Union Oil Company of California, May* 20, 1947

An anti-rust composition comprising between about 5% and 95% by weight of an oil-soluble metal soap of a semi-drying oil and between about 3% and 85% by weight of an oil-soluble metal soap of synthetic organic acids produced by the liquid phase oxidation of a petroleum hydrocarbon.

Vacuum Metalizing

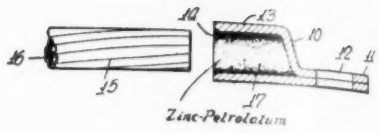
U. S. Pat. 2,420,724. *Richard M. Rice, assignor to Bausch & Lomb Optical Company, May* 20, 1947

The method of depositing a film of material on a surface of a body in an evacuated chamber which comprises evacuating the chamber to a pressure of about 0.01-10 microns, creating and maintaining an electrical discharge within the chamber by applying a potential to electrodes in the chamber and providing a thermal source of electrons in the chamber and immediately after the discharge treatment depositing a film of the material on the surface within the chamber.

Aluminum Conducting Treatment

U. S. Patent 2,423,290. *Wilhelm Friedrich Bonwitt, assignor to Burndy Engineering Company, Inc., July* 1, 1947.

A connection comprising a stranded aluminum cable, and a connector indented thereto, that portion of the cable contained in the connector having the interstices between the cable strands completely filled with zinc-petrolatum.



Zinc Plating Alloy Anode

U. S. Pat. 2,419,722. Sherwin P. *Lowe, Matthew K. T. Reikie, George H. Kent and George W. Long, assignors to Hudson Bay Mining and Smelting Company, Ltd., April* 29, 1947.

An alloy anode for use in the electrodeposition of zinc from a zinc sulphate solution, said anode consisting essentially of lead alloyed with small amounts of tin and cobalt and up to 1% of silver.

A process for the electrodeposition of zinc, which comprises causing deposition of zinc from a zinc sulphate solution with an anode consisting of an alloy composed essentially of lead, with small amounts of tin and cobalt and up to 1% of silver.

Vaporized Deposition

U. S. Pat. 2,420,722. *Stanley V. Peterson and Arthur F. Turner, assignors to Bausch & Lomb Optical Company, May* 20, 1947

An apparatus of the type described comprising means providing an evacuated chamber, means for holding within the chamber a body having a surface to receive an evaporated material deposit, means facing said surface for vaporizing a source of material to be deposited, a pair of electrodes positioned, respectively, on opposite sides of the body, at least one of said electrodes being formed of a material which will not disintegrate when the electrodes are energized and having an area at least as great as said surface, said last named electrode being movably mounted near said body, means for selectively moving said last named electrode into an operative position so that it is close to and at least coextensive in area with said surface, and means for energizing the electrodes.

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Gold Plate Labeling

Question: We plate brass jewelry with 24 kt. gold, the thickness of plate about five millionths of an inch. We wish to sell these pieces mounted in a box, with a label on the mounting to read 24 kt. gold plated. Is it within the federal laws to paste the label thus in the box? Where may I obtain a copy of the laws regarding labeling and stamping items of silver and gold, solid, plated and filled?

H. B. G.

Answer: At present there is no law, so far as we know, to prevent you from labeling your gold plated articles with a sticker marked "24 kt. gold plated". There is a law wherein if you plate ten millionths or more of gold, the price of the article is subject to a federal luxury tax of 20%; in other words the cost is increased 20%. In your case, however, it does not apply as you are plating approximately five millionths. There is considerable activity in the industry on this matter; a law is expected to be passed requiring seven millionths minimum gold plate on an article before it can be labeled as such. *Dr. William Blum* at the *Bureau of Standards* in Washington will no doubt be able to let you know exactly where to obtain copies of the laws regarding labeling and stamping items of solid, plated and filled precious metals.

Nickel and Chrome Spots

Question: I have a G.E. 300 hand operated On Load rectifier control. My copper tank gives good results, but I have trouble with the nickel and chrome tank. After twenty minutes the work spots and shows no amperes, with one piece in the tank, but if I put in two or more pieces the amperes will jump up to 15. I have tried it in cold and warm solution, but get no results.

W. V.

Answer: It appears your trouble is not necessarily in the rectifier, but in the nickel solution itself. This should be closely controlled as to pH, metallic nickel and anti-pit and brightening agents. The solution should also be filtered well, anodes bagged and kept clean.

If the tank is old and lead is getting in the solution, this too, should be corrected. If you are taking the work directly from your cyanide copper with the nickel, you probably have a drag-in problem. Correct this by momentary immersion in a 1% sulfuric acid solution.

Coating Spheres

Question: We are considering covering spheres of steel consecutively with two layers; the first layer must provide an electrical non-conducting film, and a second layer should be of graphite. The problem is two-fold. First, what technique of covering the spheres can be used to obtain a uniform film? Second, what film can be used to adhere well to the steel surface?

V. P.

Answer: For covering spheres with a non-conductor and conductor in sequence, would suggest that a dip coat of a fast air-dry lacquer be applied in several thicknesses, or a plastic be moulded around the sphere. In either case, metal can be electroplated by any of the surface reduction methods to create a conductor, or the graphite can be applied to the non-conductor by suspending the graphite in a very dilute solution of lacquer and thinner.

Stripping Silver

Question: I am in the musical instrument repairing business and have to strip the silver plate from instruments before I can lacquer them. Is it possible to strip silver plate from an object without using the reverse process of plating?

C. M. M.

Answer: We recommend that you use the following formula:

Sulfuric acid — 19 parts
Nitric Acid — 1 part
180° F.

Keep water out of this bath.

Aluminum Cleaner

Question: Can you recommend a cleaner for aluminum pressure cooker covers after they have been buffed down with tripoli? I am now using white gasoline and the tripoli does not come off very fast.

F. S. H.

Answer: With reference to aluminum cleaners having buffing compound on them would recommend that you use a vapor degreaser, then place the work for 5 to 30 seconds in a very weak alkaline cleaner prepared especially for aluminum. You can obtain such a cleaner from any reliable cleaner manufacturer.

One way of removing buffing compounds from metals is to immerse the work immediately after buffing, while the work is still hot from the wheel, for about five minutes in trichlorethylene, which is the material used in the vapor degreaser. By wiping after removal from this solution you will find

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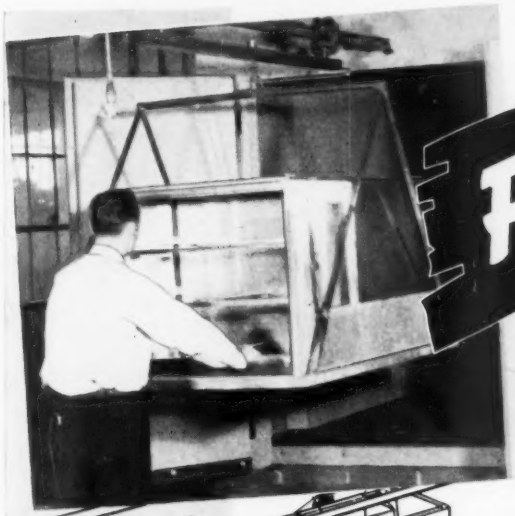

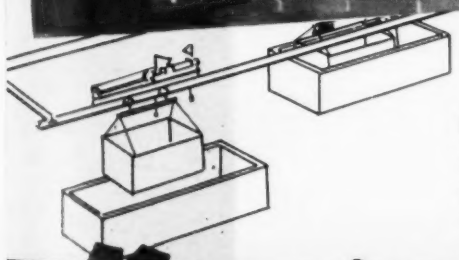

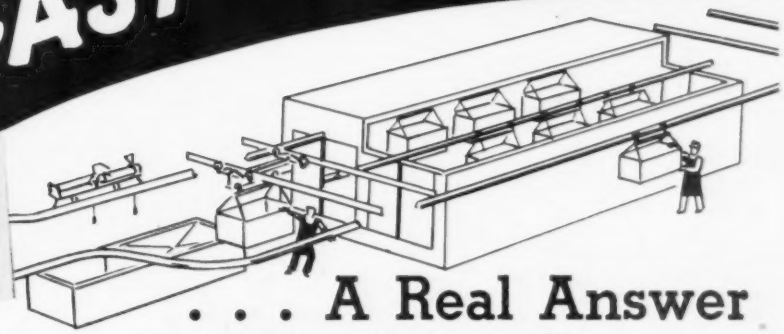

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that the gloss or sheen is not lost but that the compound has been removed.

Brass Plating Cast Iron

Question: We have trouble brass plating iron and steel parts directly in our brass plating bath. Is there some pretreatment of the metal to allow more conduction? We are mostly troubled with good plating on old kerosene lamp bases which are cast iron.

W. J. C.

Answer: No doubt you are not cleaning the cast iron properly. It is recommended that you use the folowing formula, after the regular alkaline cleaner:

Sulfuric acid	1 pint
Hydrofluoric acid	1 pint
Water	1 gallon

Immersion Copper

Question: On our hand-hammered copper line it is necessary to do some soldering. We have tried a solution of copper sulphate and nitric acid in water with some success for flash-coating the solder with copper by dipping or brushing. However, we are in doubt as to what is the best concentration for a quick immersion coating.

Also, can you suggest any other method than nitric acid wash for removing graphite from the inside of electroformed copper work?

M. J. H.

Answer: The best results for immersion of copper can be had with:

Copper sulphate	1 oz/gal
Sulfuric Acid	0.5 oz/gal
Keep solution cool	

For the nitric acid wash substitute we suggest a very rapid dip in the usual bright dip:

2 gal sulfuric acid
1 gal Nitric acid
1 qt. Water

Gold Plating Cadmium-Zinc Alloy

Question: We are having difficulty in gold plating a cadmium zinc alloy for costume jewelry. We have tried the regular method we have been using for plating sterling silver jewelry and have been unsuccessful so far. We have even tried to give this new metal a copper or brass preplate, but this has not worked.

J. H. K.

Answer: Probably, your cleaning method is too severe. We suggest a weak alkaline cleaner for a short period. It should be almost neutral. Such a cleaner may be purchased from any reliable supply house.

As for plating bright copper to improve adhesion and prevent diffusion, this should be about .0005" thick. Then plate nickel for brightness as a base for gold.

Temporary Rust Inhibitor

Question: We use a considerable amount of bright basic and low carbon steel wire in advertising displays, and generally after the fabricating of the wire, we find it necessary to thoroughly clean varying amounts of rust from some of these wire surfaces. What would be the best method of neutralizing the metal surfaces after the rust has been removed by hydrochloride acid to prevent the clean surface from immediately rusting. After the parts are cleaned they are given a dipped coat of clear agricultural coach varnish for surface protection.

W. G. A.

Answer: One of the methods of inhibiting rust on freshly pickled steel is by rinsing thoroughly and immersing immediately in an alkaline solution. This may be done in various ways; if the work is pickled in coils by means of a hoist, rinsing in cold running water immediately after pickling is advised, whereupon the coil may be immersed for about a minute in the usual alkaline cleaner which is used to remove oil and grease and which is generally operated at 180 degrees F. No harm will be done the wire if it is left in the cleaner for longer periods. If for any reason there is a delay between the pickling and alkaline immersion, the work may be stored in the running cold water tank. This type of inhibition for rust is generally effective for from two days to a week. It is of course possible to secure regular rust inhibitors which also tooth the surface, thus giving the final varnish coating superior adhesion.

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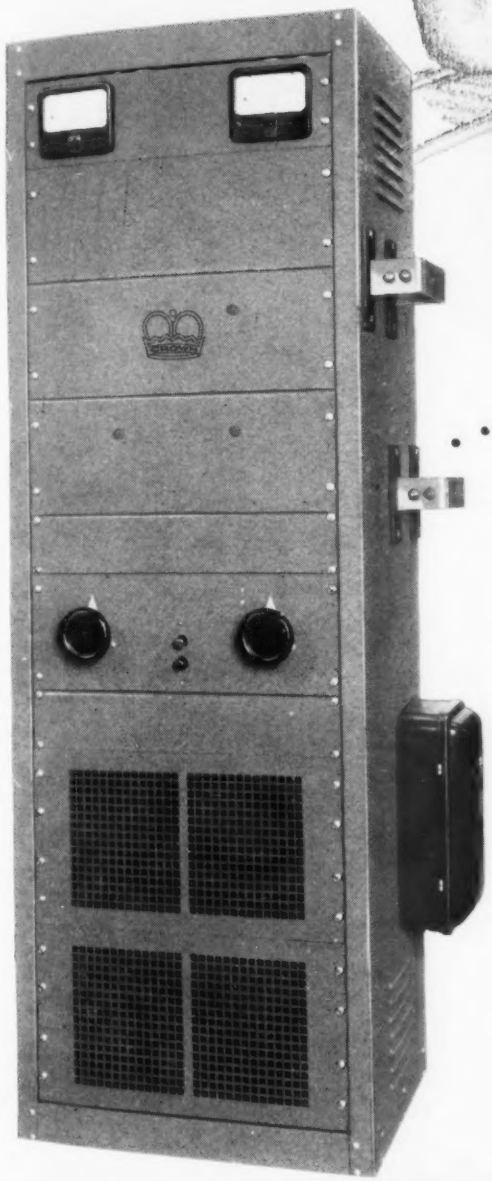

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(8 VOLTS . . . . . 1500 AMPERES)

Dual Current Output

1500 Amperes 8 volts or 750 Amperes 16 volts

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Controls and Rectifier—in one complete unit

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Engineering Data Sheet

Beginning a complete series of engineering data sheets for the use of executives and engineers who designate metal finishing operations. This series will cover the entire field of metallic surface treatments and is published in this form for convenient removal and collection in a metal finishing engineering data folder.—Ed.

Anodizing with Chromic Acid

Purpose

To apply an oxide film to the surface of aluminum and its alloys which will increase the corrosion resistance and act as a bond for subsequent paint coats.

Applicability

Suitable for all aluminum alloys except those of high copper content (over 5%). Used extensively in aircraft and excellent for uses which require painted aluminum.

Limitations

Chromic acid anodic films are relatively soft and may easily be scratched; they should therefore be protected with some organic finish. Since anodic films have a high dielectric value, anodized units are not satisfactory where electrical conductivity is necessary.

Solutions

Degreaser—vapor or solvent
Mild Alkali cleaner
Chromic acid solution (3-10%)
Hot water rinses

Procedure

1. Degrease
2. Rinse
3. Immerse in alkaline cleaner
4. Rinse
5. Anodize . . . temperature 90-100°F.
   voltage . . . 40
   time . . . 30 minutes
6. Rinse

General Notes

Thickness of coating is negligible and will not affect close tolerance fits.

Color darkens from iridescent to dull gray with increasing time, voltage or temperature.

Higher voltages permit shortening of time, but efficiencies of the bath decline.

Clamps and racking equipment become insulated during treatment and anodic coating should be removed prior to re-use.

Chromic acid films may be dyed satisfactorily, but their chief use at present is for parts which are to be painted. Thorough rinsing is necessary to prevent staining of the surface.

Precautions

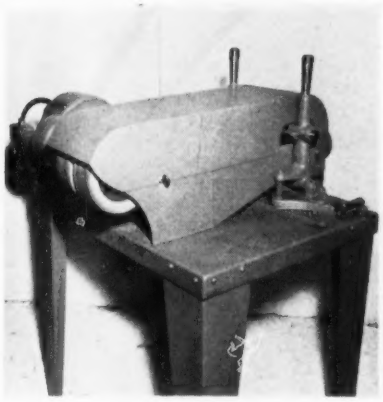
It is essential that good ventilation be provided for all anodizing tanks in order to remove the spray of chromic acid that is carried into the air by the evolution of oxygen at the anode. Chromic acid is injurious to the nasal tissues and will cause inflamation of skin if allowed in contact with open cuts or scratches; therefore, in addition to adequate ventilation at tanks, operators should wear protect clothing.

New Methods, Materials and Equipment for the Metal Finishing Industries

Recent Developments

Double Belt Bench Grinder

The Porter-Cable Machine Co., Dept. MF, Syracuse, N. Y., announces



a new addition to their line of precision abrasive belt grinders; new model DBS double belt bench grinder. Advantages of the balanced, accurate abrasive belt used on a resilient contact are claimed to result in faster, smoother and more economical grinding.

The unit is equipped with a 1 HP motor giving the abrasive belt a cutting speed of 5200 surface feet per minute. A dust guard designed so that dust follows naturally to an outlet in the rear of the unit is furnished as standard equipment. Accessory items available include an 8 inch diameter contact roll, 29 inch high or 12 inch low leg assemblies, and a wire brush attachment.

Said to be ideal for working all types of metals, the DBS performs equally well on such operations as burring gears, generating radii, weld grinding, removing flash, flat and edge work and all types of clean up and polishing operations. The whole unit is claimed to be ruggedly constructed and to run free of any vibration.

Triple Stage Washing Machine

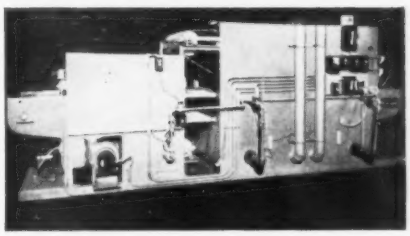
A new machine has been developed by the Mabor Company of Clark Township, Rahway, New Jersey for the processing of light, small, cup-shaped stampings of comparatively uniform depth.

The cycles of the equipment include a washing stage, rinsing stage and a section wherein the parts are dried. The hold-down conveyor can be adjusted to accommodate various types of parts, so that high, continuous production can be achieved.

The machine illustrated is gas heated by means of immersion combustion burners, although any heating method can be utilized. Any one of the three processing stages can be eliminated or additional processing stages may be added in order to bring parts nearer the point where they can be used for assembly, according to the manufacturer.

Pumps are close-coupled, and the air heat device is direct fired, although indirect firing may be substituted, if required.

In order to insure maximum safety in the operation of the equipment, it



is equipped fully with automatic safety devices for gas burners and temperature controls.

For additional information, catalog quotations, engineering data, etc., write to the Mabor Company, Dept. MF, Clark Township, Rahway, New Jersey.

Midget Wet-Tumbling Machine

A new Roto-Finish midget-size machine is announced by The Sturgis Products Company, Sturgis, Mich., as being added to the Roto-Finish line of finishing and de-burring machinery.

The new Midget is designed to permit greater time and labor economies in mechanical finishing and de-burring very small parts. It is claimed to provide greater efficiency in processing large quantities of small parts as well as small lots of parts.

Cylinders of the new Roto-Finish Midget are 8" wide, 12" across the flats and has a variable drive of 35 to 70 RPM. Flats are lined with kiln dried hard maple and ends are rubber sealed. Cover is secured to cylinder and the cylinder mounted on the machine by an ingenious lock and adjustable clamp that permits quick loading and unloading. Machine can be supplied without base for bench mounting and hand parts separator is supplied and equipped with drain connection. Interchangeable screens are available in all mesh sizes for separation of chips from parts.

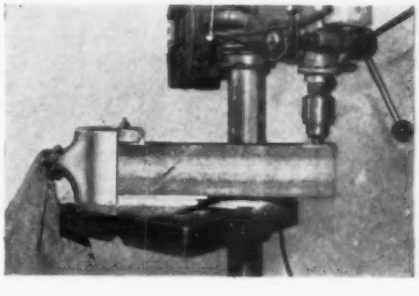
Installations where the new Roto-Finish Midgets are most suitable are small plating shops; manufacturing plants with small finishing departments; and those plants engaged in furnishing only very small parts.

All mechanical finishing operations may be performed in the Roto-Finish Midget—grinding de-burring, polishing, britehoning and coloring. The controlled rotary action of the wet mixture of Midget chips and compound produces a surface suitable for plating by removing uniformly burrs, sharp edges and corners on small stampings, machined parts, die castings.

For complete information write to The Sturgis Products Company, Dept. MF, Sturgis, Mich.

Belt Sander for Drill Press

A new, simple, practical method for many surface finishing jobs on wood, metal, plastic and other materials has been announced by the OK Specialty Company of Chicago. The new finishing method takes the form of the OK Belt Sander, a drill press attachment. The new sanding device weighs less than 5 pounds. It is made up of an aluminum base with backing plate or platen, a driven pulley mounted on



ground steel shaft and running on precision ground ball bearings, and cast aluminum driver pulley mounted on ½" ground steel shaft to fit into the drill press chuck. The base of the sander is bolted to a drill press table. Merely by moving the drill press table, the attachment can be adjusted to handle sanding belts from 26" to 36" in length. It is the manufacturer's opinion that the OK Belt Sander is the only mechanical sander with this adjustable feature.

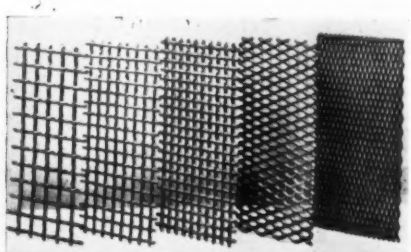
The sander takes belts from ½" to 3" in width. Two sanding belts, one coarse grit and one fine grit, are furnished with each attachment. The device comes assembled ready for use with any drill press. Most efficient performance is achieved at 3500 to 5000 rpm. The sander stands 5" high, and the base measures 10½" long by 3¼" wide.

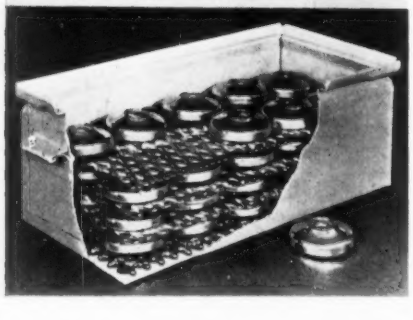
An illustrated folder, "KO the Work with the OK Belt Sander," is now ready for distribution. Readers may secure a copy by writing OK Specialty Company, Dept. N-77-MF, 4655 N. Clark St., Chicago, Ill.

Rubber Material Handling Separators

Woven wire screen and expanded or perforated metal in all mesh and sizes, completely covered with rubber, is announced as available for material handling purposes by Automotive Rubber Company, Inc., Dept. MF, 8611 Epworth Blvd., Detroit 4, Mich.

Purpose of the screens is primarily to protect by rubber cushion, parts which have been plated, painted or





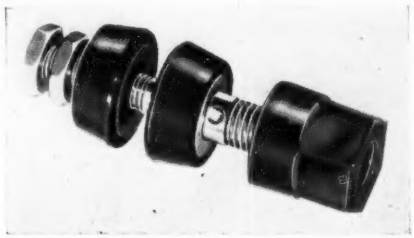
precision finished so they will not become scratched, marred or disfigured by contact with metal surfaces. The mesh separators likewise permit drainage.

Any size separators can be furnished to fit bottoms of tote pans, conveyor baskets or pallets and can be covered with hard, semi-hard or soft natural rubber or synthetic rubber to meet specific conditions encountered.

Such screens have also been used successfully in trials as separators in palletizing and stacking parts. In these applications, it has been found that rack, tipping and skidding of the tiers is materially reduced.

Electrical Connector Post

The new Superior binding post (type DF30) meets the need for a multi-purpose electrical connector. In contrast to the usual connectors which permit only one or two methods of



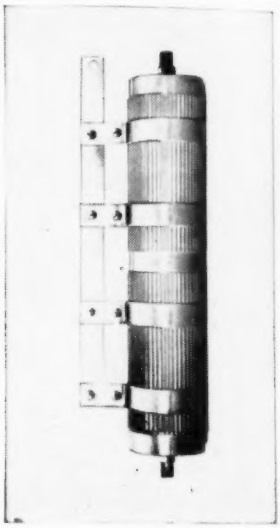
connection, the new binding post is said to offer five ways of connecting leads. The five connections are; permanent clamping of wire up to size No. 12 through the center hole; looping of wire around the center shaft and clamping; plug-in connection of a standard ¾ inch center banana plug; clip-lead connection by removing the hexagonal shaped phenolic head; and spade lug connection.

In addition to the versatility of connection, the new binding post is claimed to provide complete insulation of the post from the mounting panel. To assure rugged construction, extra-strong hard phenolic material is used for the head and sliding members. Employment of this material permits tightening of the hexagonal shaped head with a standard ½ inch socket wrench. All metallic components are recessed assuring a dead front for instrument and user protection. The current carrying capacity is 30 amperes. This new binding post is complete with all components ready to mount on any panel up to ¼ inch thick.

Further details may be obtained by writing The Superior Electric Company, Dept. MF, 485 Church St., Bristol, Conn.

High Amperage Rectifier

Selenium rectifiers produced through a new method of electrolytically depositing selenium have been developed by Ion Industries, Inc., Dept. MF, River-



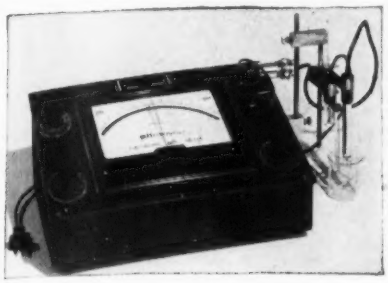
dale (Chicago 27), Ill. These rectifiers are cylindrical in shape with circulating liquid cooling for more efficient heat dissipation to produce unusually high amperage capacity, many times greater than was previously considered possible, according to the manufacturer.

The rectifiers are constructed in standard unit elements. Assemblies can be made in the number needed for the output in amperes and voltages required, connecting in series or in parallel, in capacities from 250 amperes of the standard single element to assemblies for large scale industrial applications.

It is said that the unit has many applications in the electrolytical industry including metal deposition, metal refining and metal surface treatment for heavy amperage capacities. Aside from the recognized advantages of liquid cooling, a complete hermetical seal of the active surface area is said to be possible, thus assuring long-life, trouble-free operation. The Ion selenium rectifier shown in the accompanying illustration is the Standard S-300 Unit with a rating of 250 amps. continuous, 500 amps. intermittent. Size is 6" high, 3" wide, and 6¼" in depth; weight is 4 lbs.

Electronic pH Meter

A new universal, line-operated electronic instrument has recently been marketed by the Photovolt Corporation. The unit is designed for all types and designs of electrodes for pH, titration and oxidation-reduction potentials; it is capable of handling A. C. power lines of 90-275 volts at 50-60 cycles.



The instrument is stated to be standardized with the aid of a single buffer solution and a single control knob. By means of a tell-tale hand to mark the reference point, it is said to be possible to restandardize the instrument in the course of actual measurements without the use of a buffer. Temperature control is designed for 0-100 degrees C operation, eliminating the use of temperature correction charts.

The standard glass electrode furnished with the instrument is fully shielded and it can be used either attached to the pH meter or installed some distance away, it is claimed. The standard electrodes are designed to carry out measurements on quantities as low as 5 ml. Special adapters permit the use of electrodes of other makes and special designs.

The electronic tubes and calibrating control are said to be easily accessible from the rear of the housing without removing the instrument panel.

To obtain further information and descriptive literature, write Photovolt Corporation,, Dept. MF, 95 Madison Ave., New York 16, N. Y.

Stop-Off Masking Lacquer

Fine hairline demarcation in masking parts prior to selective plating is now said to be possible for the plating industry through use of Miccrostop, a stop-off lacquer just developed by the laboratories of Michigan Chrome and Chemical Company, producers of other platers' aids, including Miccromask, Miccrotape, Miccroloid, Miccrolac, Miccrotube, Miccrotex, Miccroplastic and Miccrostrip.

Miccrostop was developed from new synthetic resins and has adhesive qualities that are claimed to hold to a fine degree of accuracy through boiling cleaners, acid rinses and all selective plating cycles. It can be applied by brush, dip or spray and is said to be easily removed after plating. Miccrostop has good dielectric strength, resulting in hairline demarcation with no loss of current. It elminates the possibility of a lacquer etch on precision-lapped finishes, according to the manufacturer, and it possesses rapid air-drying qualities reducing drying time between coats and in preparation for racking. Absolutely neutral, it will not contaminate any plating solution, and can be used through all plating cycles including high-speed copper, decorative chrome, phosphate coatings, alloy solutions, zinc, tin, gold, silver, nickel, cadmium, gold on silver, or silver on gold, it is claimed.

Samples are available without cost or obligation by writing Michigan Chrome and Chemical Company, Dept. MF, 6340 E. Jefferson Ave., Detroit 7, Mich.

Liquid Tripoli Composition

The Hanson-Van Winkle-Munning Company, Dept. MF, Matawan, N. J., announces that they have perfected four grades of a new liquid tripoli

Right! IT'S "GOOD-BYE FOREVER" TO OBJECTIONABLE ODORS OF OLD-FASHIONED ADHESIVES!

BACK IN the horse and buggy days you couldn't avoid it. But now you don't have to stand for it—you don't have to put up with Stockyards Odor in polishing adhesives one minute longer. Do as progressive plants everywhere are doing. Switch to GRIPMASTER . . . the modern, more efficient, odor-free polishing wheel cement. **There's NO S.O. IN GRIPMASTER!**

Among America's leading industries . . . and in foreign countries over the globe . . . GRIPMASTER leads the way to new profits from polishing. *Do this now.* AT OUR EXPENSE, discover for yourself how GRIPMASTER (with its secret high-heat resisting ingredient) can increase *your* production . . . give you far more pieces per head! Clip coupon below. Send for generous free sample *today!*

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For DEGREASING • WASHING
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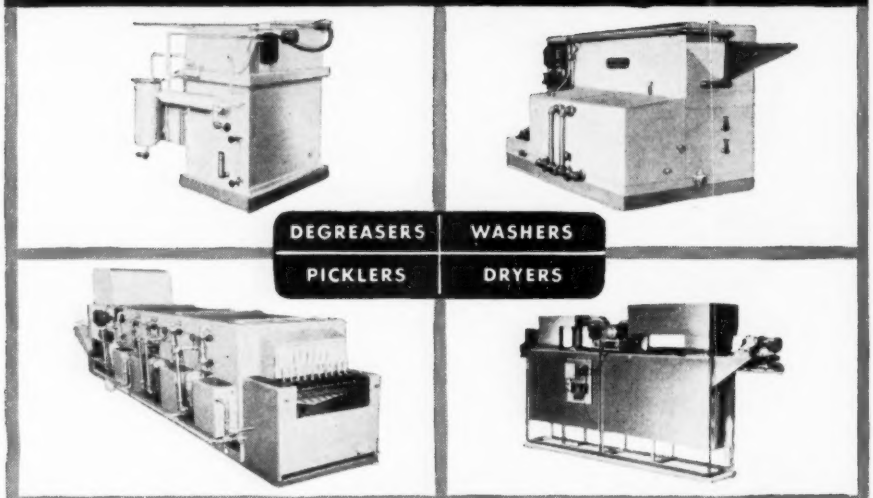
of METAL PARTS



Standard and Special Types of equipment from the smallest to the largest sizes for a wide variety of metal degreasing, washing, cleaning, rinsing, pickling, drying and allied process operations.

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OPTIMUS EQUIPMENT COMPANY

Engineers and Manufacturers

11 WATER STREET. MATAWAN, N. J.

OPTIMUS EQUIPMENT

FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

composition, Acme No. 2-L-170, 2-L-75, 2-L-77, and 2-L-79.

The company has also entered into an agreement with Eclipse Air Brush Company for the distribution of their equipment for the application of these liquid tripoli compositions and is therefore prepared to supply complete installation and service.

The characteristics of the new Acme Liquid polishing compositions are claimed to be as follows: 2-L-70, double duty with superior color; 2-L-75, medium cut with good color; 2-L-77, good cutting with medium color; 2-L-79, heavy cut with medium color.

These compounds are said to have been tested in production for a number of months and each grade has demonstrated marked efficiency.

Acme liquid tripoli can be used with any approved type of spray equipment but if the operator has never used liquid compounds before, Eclipse spray equipment is recommended.

Where liquid compositions can be suitably applied, the apparent advantages over bar type are claimed to be as follows: large savings in amount of compositions used; considerable savings in buffs; higher color per degree of cut; ease of application.

Small Parts Cleaning Machine

Now equipped with its own specially designed motor made by L & R in its own plant, the Industrial Precision Cleaning Machine is again offered by

the L & R Manufacturing Company of Arlington, N. J. for the processing of instruments and small metal parts too difficult to handle manually or in any other type of equipment.

With liberal use of ball bearings in the motor and in the new shaft that supports the work basket, the equipment is engineered for long life and smooth, trouble-free operation. The work basket measures 3⅜" deep x 5½" in diameter into which the triple nesting baskets fit so that three sets of parts can be cleaned at one time without the danger of their becoming mixed. The unit is also furnished with controlled reversing action which adds materially to the machine's efficiency. Aluminum cups under the jars assure more protection for the pyrex containers and perfect alignment with the basket.

The unit is completely self-contained and cleans, rinses, polishes and dries parts which are too delicate for manual handling or for processing in other types of equipment. Sections of the triple baskets can be sent to various departments to prevent contamination of the parts before they are assembled.

For full information, write to the L & R Manufacturing Company, 577 Elm St., Arlington, N. J.

Automatic Electronic Voltage Regulator

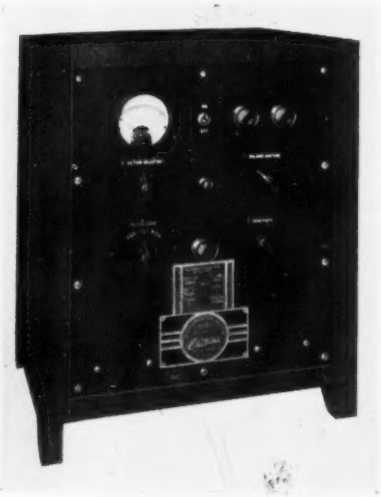
For pre-selected D. C. output voltage to be maintained at a constant level the new automatic voltage regulator is designed to maintain constant D. C.

output voltage regardless of the ampere load current.

For example, on a 9 volt rectification unit with a motor driven stepless control, this automatic voltage regulator is claimed to maintain the D. C. output constant at 9 volts whether the output current load is 100 amperes or 5000 amperes. Also by presetting the desired voltage this same installation can be maintained at any constant voltage between 1 and 9 volts.

The voltage regulator is stated to have maximum regulation sensitivity. At any preset voltage, a voltage change of plus or minus 1/10 to ¼ of a volt will cause instantaneous control reaction.

Features include a voltage selector preset switch, pilot light that shows



changing loads, low power consumption; no maintenance, compact, easily handled unit.

The equipment is designed for 115 volt, single phase, 50/60 cycles A.C. input; standard model is for 1 to 9 volt D. C. output. Models can be designed to meet any specifications for any line voltage and frequency. Dimensions 18" high, 14" wide, 12" deep.

For further information, write Richardson-Allen Corporation, Dept. MF, 15 W. 20th St., New York, 11, N. Y.

Patch Type Gloves

The Surety Rubber Company, Dept. MF, Carrollton, Ohio, introduces a glove designed to solve the hand protection problem in industries where both adequate protection and sure-gripping are required of a glove. This Dupont neoprene patch type glove is claimed to be rugged enough to insure safety and the corrugated patches on palm, thumb and fingers provide positive gripping action in key spots. The patches extend over the end of the fingers to guard fully against slippage and to provide double thickness at points of greatest stress.

Made of the same material as the glove, the patches are uncured when first attached and are cured along with the glove itself to insure permanent adhesion. The glove is available in sizes 10 and 11; the color is black.

Tumbling Method and Equipment

Said to be a fast and inexpensive process that readily lends itself to the demands of production, Liquid Honing has been developed in conjunction with tumbling and deburring equip-

RACKS WEAR OUT— COATINGS DON'T!

Unichrome Coating 203 outlasts racks in severe bath

Six weeks in an anodic, hydrochloric acid treatment eats away rack contacts, yet leaves Coating 203 untouched—reports a large, industrial plant! One more case where a Unichrome coating actually outlasts the rack!

And you can be sure 203 will give you extra service in *any plating process.* It has proved it can take them all in hundreds of plating plants. Save time, money—and racks—by availing yourself of this tougher air-drying coating. Write for prices and details.

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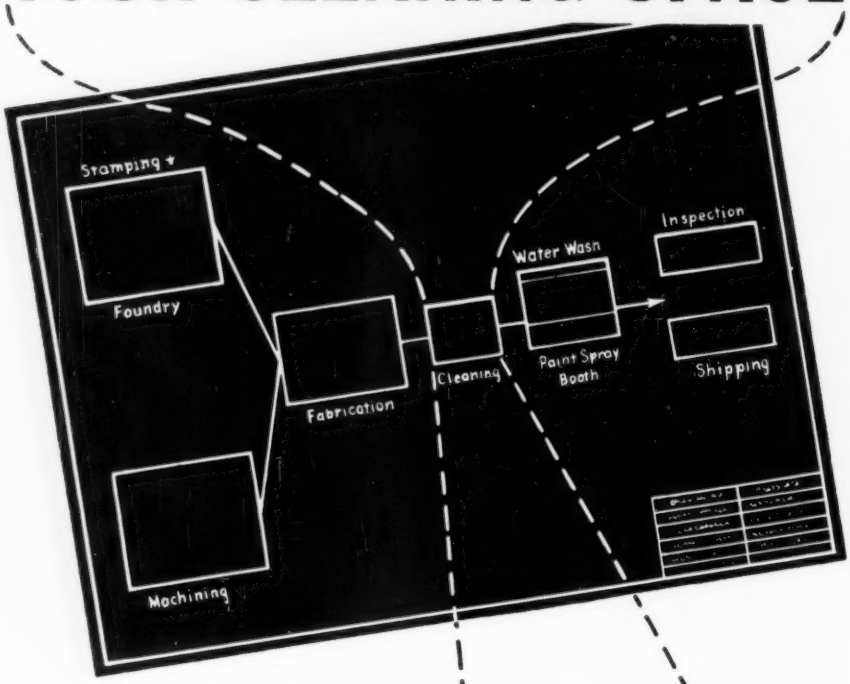


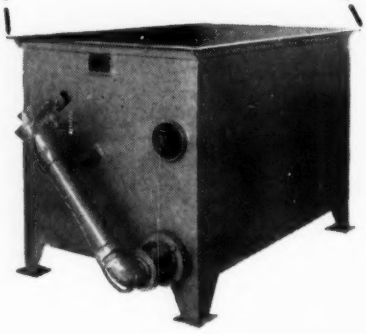
Will more than Pay Off

—when you install cleaning materials and methods tailored to metal finishing problems. Detrex products can help you.

Detrex Triad Emulsions

Wet out soil quickly
Do not attack metal
Rinse freely in water
Eliminate fire hazards
Protect work from rust

Call the Detrex field representative nearest you for more information on these products.



Detrex All-Purpose Tanks are heated by steam or gas. Available in standard sizes, they are ideally suited to cleaning departments requiring ready-built installations.

A-169R

DETREX Corporation
DETROIT 32, MICHIGAN

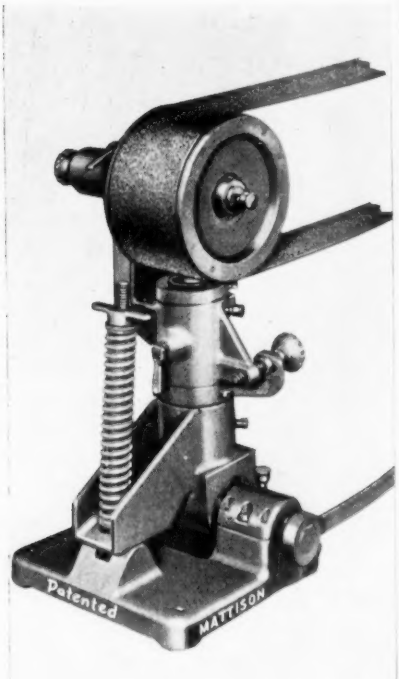
ment by the Vapor Blast Mfg. Company.

The method and equipment is claimed to give superior surface preparations for coating, buffing, electropolishing, scale removal and surface inspections of all metals. Deburring of precision machine parts, stampings, die castings, couplings and all types of gears can also be performed. Honing of motor cylinders by use of the process as well as turbine blades, tools, dies, molds and all wear parts for better lubrication control through non-directional finishes may be accomplished, according to the manufacturer. The removal of rust, carbon, oxidation and wear polish, surface reclamation and salvage, as well as microscopically cleaned surfaces for storage are ably handled.

Vapor Blast Mfg. Co., Dept. MF, 333 S. 16th St., Milwaukee 3, Wisc. will supply additional information upon request.

Abrasive Belt Backstand Idler

A new abrasive belt backstand idler for polishing and buffing machines has recently been announced by the Mattison Machine Works.



Of substantial construction throughout, the ball bearing idler pulley is mounted on the yoke which can be swiveled by the lower handwheel to track the belt on the pulley, while the upper handwheel provides cross adjustment of aligning idler pulley and

the driving pulley with each other. Abrasive belt tension is automatically taken up by a sensitive spring mechanism, which is adjustable for various widths of belts. For replacing belts, a cam lever is provided to relieve spring tension on the idler pulley arm. The stand can be adjusted to be used for either right or left hand by turning the yoke, carrying idler pulley and upper assembly half around.

To secure further information and specifications write Mattison Machine Works, Dept. MF, Rockford, Ill.

Outside Exhaust Dust Collector

Designed especially for collecting dust, lint, and dirt from heavy duty polishing, grinding, and buffing work in those states where outside exhaust is mandatory, Model 11N50 Dustkop is added to its line of industrial dust collectors by Aget-Detroit Company, Dept. MF, Main and Washington Sts., Ann Arbor, Mich.

Instead of the customary second stage filter of spun glass and its hand shaker-crank, the cyclone separator is provided with a stack connecting sleeve so that piping can easily be installed to convey the cleaned air out-of-doors. This design is to permit approval of unit type installations in the several states requiring outside exhaust and prohibiting recirculation of cleaned air; notably, New York and Wisconsin.

Powered by 1½ horsepower, continuous duty motor, direct driving paddle wheel, self-clearing fan, the unit develops in excess of 1500 cfm at 3.2 inches static suction on a 6½ inch diameter inlet, according to instrument tests. Thus, the unit is claimed to be capable of handling heavy duty loads of shavings and chips from woodworking and from metalworking, and lint and dust from polishing and grinding operations.

Removal of the collected dust is by means of a dust drawer in the base of the collector and other than the occasional removal of the collected dust, no other maintenance is required, it is claimed.

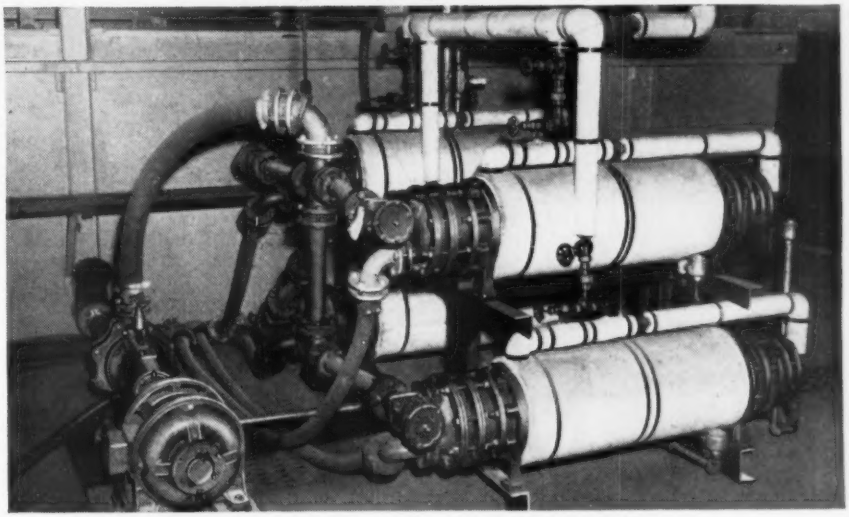
Magnetic Screen Trap

The Cooney Valve and Screen Co., Erie, Penna., have announced an invention of unique construction, incorporating a special mesh screen and a powerful Eriez Permanent Magnet built into a single, compact unit.

Self-Protected Heat Exchangers for Handling Corrosives

Durco Heat Exchangers are made of Duriron, a high silicon iron that possesses greater resistance to acids, generally, than any other commercially available alloy. The corrosion resistance is permanent and uniform throughout.

These heat exchangers are ideal for heating plating solutions, especially bright nickel, copper and chrome.



The four units pictured here are on a 10,000 gallon 9-H bright nickel installation. Operating at 75 lb. steam pressure, they maintain the solution at exactly 150° F. and plate 1.5/1000″ nickel in 35 minutes. Write for *new* bulletin 1603 which describes Durco heat exchangers in detail. 40-GM

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON CO., INC. • DAYTON 1, OHIO

The body of the trap is made of brass, bronze or aluminum. The screen is without braces, stanchions or supports which is said to offer a clear, unobstructed filtering area. It is a unit separable from the screw cap to facilitate cleaning, renewal or change of wire mesh. The combination of the screen trap and a powerful permanent magnet, when placed in a liquid, vapor, gas or air line is claimed to stop all abrasive material—both magnetic and non-magnetic. Flow of material is stated to be maximum with a minimum of pressure drop.

The new trap is said to be of special interest to mechanical, chemical or food product engineers, superintendents, master mechanics and millwrights who have the serious problem of removal of ferrous and non-ferrous particles from lubricating oils, fuel oils, hydraulic systems, cutting oil coolants, foods and medicinal supplies.

Full particulars on the trap can be secured by writing the Cooney Valve and Screen Co., 18-M, Dept. MF, P. O. Box No. 1358, Erie, Penna.

Electric Glue Heater

The Hanson-Van Winkle-Munning Company, Dept. MF, Matawan, N. J.,

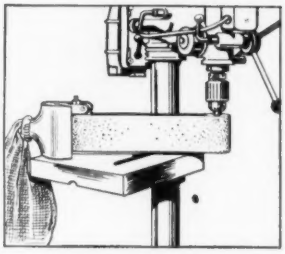
NEW BELT SANDER FOR DRILL PRESS
Does Finishing Jobs Faster, Better

A new, simple, faster method for many surface finishing jobs on wood, metal, plastic and other materials has been announced by the OK Specialty Company of Chicago. The new finishing method takes the form of the OK Belt Sander, a drill press attachment.

The new sanding device weighs less than 5 pounds. It is made up of an aluminum base with backing plate or platen, a driven pulley mounted on ground steel shaft and running on precision ground ball bearings, and cast aluminum driver pulley mounted on ½" ground steel shaft to fit into the drill press chuck.

The base of the sander is bolted to a drill press table. Merely by moving the drill press table, the attachment can be adjusted to handle sanding belts from 26" to 36" in length.

The sander takes belts from ½" to 3" in width. Two sanding belts, one coarse grit and one fine grit, are furnished with each attachment. The device comes assembled ready for use with any drill press. Most efficient performance is achieved at 3500 to 5000 RPM. The sander stands 5" high, and the base measures 10½" long by 3¼" wide.



OK Belt Sander
Assembled, Ready for Action

Another time-saver on the job is chewing gum. Chewing gum may be used even when hands are busy; and under dust conditions helps to keep the throat moist—prevents "false thirst." For these reasons many plant owners make Wrigley's Spearmint Gum available to everyone.

You can get complete information from
OK Specialty Company,
4655 N. Clark St., Chicago, Ill.

AB-71

announces the development of a new portable electric glue heater.

This unit is said to be well constructed, provides quick heat, automatically held at 150° to 160° F. by a thermostat and is thoroughly insulated to prevent heat loss. The removable glue pot is of copper, nickel plated for corrosion and wear resistance. A heavy duty, insulated electric cord is supplied with each heater.

The capacity of the electric glue heater is 2 quarts. It is designed for regular 115 volt AC Current. Special units for 230 volt AC Current can be supplied.

The use of these glue heaters improve the efficiency of any polishing room.

Metallizing Spray Booth

A new stainless steel spray booth which serves as a complete production unit for silver spraying objects in preparation for electroplating has been

developed by the Monomelt Co., Inc., Dept. MF, 1611 N. E. Polk St., Minneapolis.

The unit is adapted to silver spraying plastic jewelry, plaster of paris and plastic figurines, composition toys, glass trays and dishes, wooden novelties, radio and automobile parts and similar products.

The booth is equipped with foot-operated water spray, air reducer, plate glass baffle to protect operator, air pressure indicator, safety valve and a rotating jig for holding objects to be sprayed. A powerful suction fan draws excess spray out of the booth through a duct directly behind the jig. A fluorescent light is built into

the ceiling of the booth to give adequate, non-glare illumination.

Constructed of stainless steel, the spray booth is impervious to chemicals that corrode ordinary metals. Its smooth, simple design is said to make it easy to keep clean.

A typical application of the booth is its use in one plant for spraying square plastic caps designed to fit containers for a new line of perfume.

The caps are first sensitized by dipping into a solution of stannous chloride, followed by a water rinse and a final rinse with distilled water.

Caps are then mounted on small, upright strips of brass which in turn fit into holes in a wooden frame on on the jig.

The operator coats each perfume bottle cap with a thin layer of pure metallic silver. This is done with a spray gun which delivers a silver nitrate solution simultaneously with a reducer solution. In order to expose the various surfaces of the cap to the spray, the operator turns and tilts the ball-and socket-mounted jig in any desired direction.

The caps are now electro-conductive and are ready for the final electroplating process which gives them a shining, substantial metallic finish to fit into the color scheme of the packaging.

Independent Drive Buffing Lathe

The Standard Electrical Tool Company, Dept. MF, 2503 River Road, Cincinnati 4, Ohio, are now offering their two-motor proper speed buffing and polishing machine with the overhang base construction as illustrated. The "E" dimension is 13" and reflects a convenience in handling large or bulky work. "A" dimension is standard of 7", but is available in either 11", 17", 20", or to order.

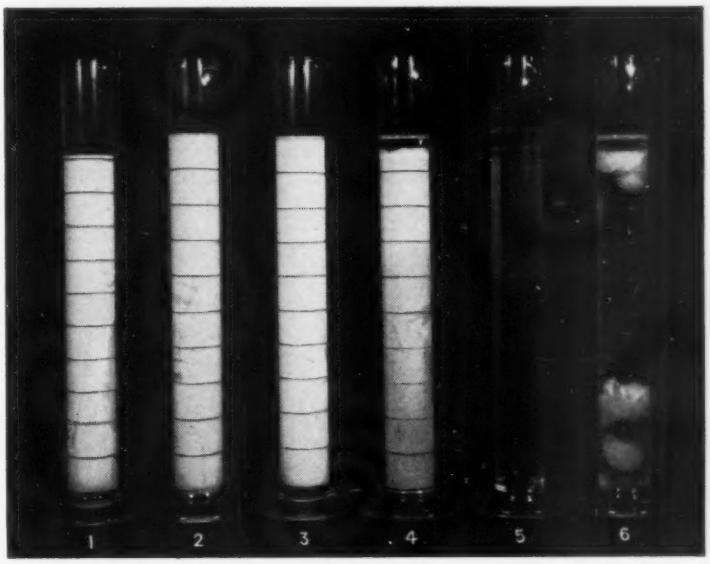
The phantom view illustrates that each side of the machine is independent of the other, having its own motor, starting equipment, multiple V-belt drive, shaft lock, etc. This arrangement permits each operator to be independent of the operation on the other side of the machine.

Optional equipment is hand brake for quickly stopping the spindle, or the coincidental arrangement of stopping the spindle and shutting off the current.

Available in sizes to include 2, 3, 5, 7½, 10, 15 and 20 hp motors. Spindle speed of user's selection. Also available

Emlon enters the metal-cleaning field!

Wyandotte Chemicals Corporation announces a new detergent of solvent emulsion type — Emlon. This versatile product is especially made to meet *all* requirements for such a cleaner — as determined by the experience of Wyandotte Service Engineers.



Unretouched photograph showing the comparative stability of Emlon (1, 2 and 3) and a leading competitive product (4, 5 and 6)

Above you see the following 5% emulsions, after standing for 24 hours:

(1) Emlon in tap water; **(2)** Emlon with 2.5% of sulfuric acid added; **(3)** Emlon with 2.5% of caustic soda added; **(4)** Competitive product in tap water; **(5)** Competitive product with 2.5% of sulfuric acid added; **(6)** Competitive product with 2.5% of caustic soda added. Note separation, or breakdown, of 4, 5 and 6.

This illustrates the unusual *stability* of emulsions formed with Emlon. This stability results in better and faster cleaning action, longer cleaning solution life and low cleaning costs.

Ask your Wyandotte Service Engineer about this new and different product and its many applications in the metal-cleaning field — or write directly to us for descriptive literature.

Wyandotte
REG. U. S. PAT. OFF.

WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

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ALL TYPES OF RACK INSULATION

¶ Baking type plastisol—one or two coats provides an extremely heavy and tough insulation which stands up in all plating solutions with insulation life measured in months instead of weeks. BUNATOL NO. 1000

¶ Solution type air dry insulation. For quick low cost insulation that air dries fast and gives long insulation life. BUNATOL NO. 160 and NO. 785

¶ New low temperature bake primer with fast air drying coats over the primer; makes an extremely interesting low cost insulation which has unusual adhesion and remarkable insulation life with decidedly less expense. BUNATOL NO. 609

¶ A new one coat lacquer to stop corrosion on tanks, machinery, fume ducts, etc. One coat gives protection actually expected from three coats of usual materials. BUNATOL Lacquer NO. 731

¶ Stop Off for selective plating. BUNATOL NO. 474 Red for Chrome and BUNATOL NO. 608 Green for Copper or Chrome.

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TOLEDO 7, OHIO

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with "Speedial" control on each spindle to provide an infinite speed range between 1500 and 3000 r.p.m.

Each spindle assembly is equipped with 3 ball bearings adequately protected in liberal size oil reservoirs, with Sight Feed oil gauge on each bearing housing. The spindle has acme threads and hard bronze spindle nuts.

Business Items

Hayes Named by Bullard Company

Frank U. Hayes, assistant sales manager of the Bullard Company, Bridgeport, Conn., for the past five years, has been named sales manager, and *E. Payson Blanchard*, sales manager, has been named director of sales, according to an announcement by *E. C. Bullard*, president and general manager.

Mr. Blanchard will be in charge of general administrative sales policies and Mr. Hayes will be responsible for executive sales functions, Mr. Bullard said.

Mr. Hayes was associated with the Baldwin Locomotive Works in Philadelphia after graduation from Lowell Institute at Cambridge, Mass. He joined the Bullard machine tool plant in 1935 and within a year had been assigned to the sales division with the Middle Atlantic states as his field.

Mr. Hayes was named assistant sales manager in 1942, a position he has held until his present appointment.

Frank U. Hayes

Pennsalt Names Duffy Special Chemicals Sales Manager

The appointment of *Joseph J. Duffy, Jr.*, as manager of sales of the *Special Chemicals Division* of the *Pennsylvania Salt Manufacturing Company* has been announced by *George B. Beitzel*, vice president in charge of sales.

Mr. Duffy, formerly assistant manager of sales in the division since February, 1945, assumes the position formerly held by *William P. Drake*, recently appointed assistant vice president.

A graduate of Villanova College in 1937 with a degree of Bachelor of Science in Chemical Engineering, Mr. Duffy joined Pennsalt the same year. He has been associated with the Special Chemicals Division since early 1939 and for three years served as sales-service engineer for the Division in the New York State territory before coming to the Philadelphia office in 1942.

Mr. Duffy is a member of The American Chemical Society, The American Electroplaters Society, The American Institute of Chemical Engineers and The American Society for Testing Materials. Mr. and Mrs. Duffy and their four children live at Aldwyn Lane, Villanova, Pa.

Harry M. Dexter Appointed C-D Sales Manager

Continental-Diamond Fibre Company, Newark, Delaware, announced the appointment of *Harry M. Dexter* as sales manager effective June 2nd. Mr. Dexter, formerly in charge of the Cleveland Sales Office, has transferred his activities to the main office in Newark, Delaware, since August 1st.

Karry Appointed by Division Lead Company

The Division Lead Company, manufacturer of *Divco 71-Point* lead anodes, announces the appointment of *Wm. E. Karry* as director of methods and procedures. His duties will be mainly centered in the promotion of lead anodes for chrome plating, electro-stripping, cleaning and electro-polishing. He is the head of an experienced technical staff which is prepared to give every assistance in solving metal finishing and surface preparation problems.

Other Division Lead Company products include lead lined tanks, lead steam coils and all other custom-built lead-fabricated equipment. In addition, a number of specialized chemicals

Wm. E. Karry

for metal cleaning and processing are marketed under the *Tabby* trademark.

Mr. Karry was born and raised in Chicago where he received his B.S. from Central College. Previous experience includes three years with the Metallurgical Department of a *United States Steel* subsidiary and four years with the *Karith Chemical Company*.

● Users tell us repeatedly that their polishing costs are lower when they change to LIONITE Abrasive Grains for set-up wheels. Actual production figures from a variety of polishing operations bear this out.

JOB NO. 1 **Polishing wheels of size 46 CBT Lionite polished 90 to 130 discs and corn planter runners per wheel. The grain previously used only lasted for 40 to 60 pieces per wheel.**

JOB NO. 2 **In polishing hammers, wheels of size 46 NB Lionite lasted an average of 2½ hours each where another make of grain lasted 1¼ hours.**

If you are interested in lower polishing costs (and who isn't?), ask to have a Lionite representative go over your polishing operation. His recommendations may result in very worthwhile savings.

GENERAL ABRASIVE COMPANY, INC.

Lionite and Carbonite Abrasive Grains

NIAGARA FALLS, NEW YORK, U. S. A.

FOR BETTER PLATING . . . AT LOWER COST

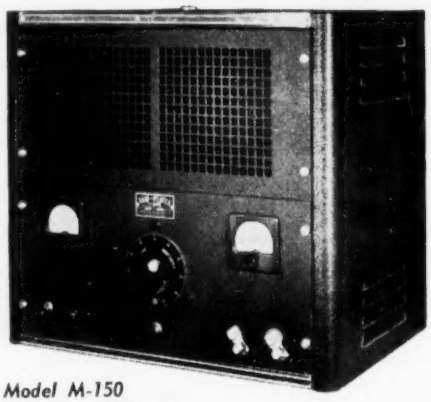
It's the VARI-PLATER*
PACKAGED INDUSTRIAL RECTIFIERS

★ VERSATILE
★ VARIABLE DC VOLTAGE
★ INSTANTANEOUS DC POWER
★ EXTREMELY COMPACT
★ STURDILY CONSTRUCTED
★ SIMPLE TO INSTALL
★ ECONOMICAL TO OPERATE
★ EASY TO MAINTAIN
★ FULLY GUARANTEED

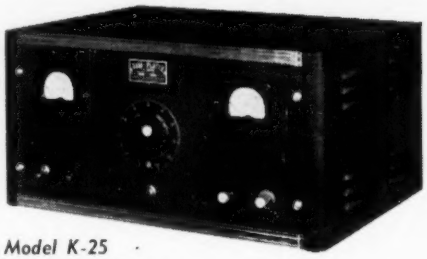
For laboratory and production work Lewis Electric offers a complete line of portable packaged industrial rectifiers ranging in output from 8 volts 25 amps to 8/16 volts 500/250 amps, and in size from 10½" x 21" x 15" deep to 42⅞" x 22" x 18" deep.

*REG. TRADE MARK

FOR MORE INFORMATION WRITE TODAY FOR YOUR FREE COPY OF "LEWIS RECTIFIERS FOR ELECTRO-PLATING."



Model M-150
0-8 volts—150 amps
Model MD-150
0-8/16 volts—150/75 amps



Model K-25
0-8 volts—25 amps
Model K-50
0-8 volts—50 amps

FOR PLATING

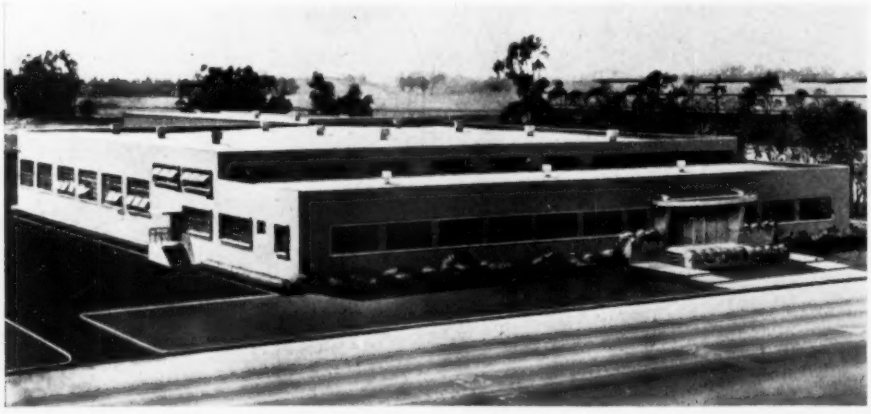
- GOLD
- SILVER
- CHROMIUM
- NICKEL
- BLACK NICKEL
- COPPER
- CADMIUM
- BRASS
- BRONZE
- COBALT
- IRON
- LEAD
- PALLADIUM
- RHODIUM
- TIN
- ZINC
- ALLOYS
- *On Metals and Non-Metals.*

LEWIS ELECTRICAL MANUFACTURING COMPANY
1266 GUN HILL ROAD, NEW YORK 67, N. Y.

Selenium Corporation of America in New Home

Selenium Corporation of America, an affiliate of Vickers Incorporated, manufacturers of a broad and comprehensive line of selenium power and instrument rectifiers and self-generating photo-electric cells, is now occupying a recently completed modern structure providing more than 32,000 square feet of floor space at 2160 E. Imperial Highway, El Segunda, Calif.

Production volume has been considerably increased by the installation of latest equipment or highly specialized operations. Engineering, inspection and testing facilities have been greatly expanded to insure uniform excellence of products with the maximum of efficiency.



Pioneer Steel Ball Elects Donahue Secretary

J. H. Donahue, newly-appointed general sales manager of *Pioneer Steel Ball Incorporated*, Unionville, Conn., has been elected secretary of the corporation according to an announcement made by *N. Martinelli*, company president.

In January 1946 Mr. Donahue left Hartford to join the *Gulf Publishing Company* of Houston, Texas, as circulation manager. His resignation from that position marks his return to the steel ball industry, with which he was previously associated for over fifteen years. A native of Hartford, Mr. Donahue has been active in the Hartford Sales Manager's Club, National Industrial Advertisers' Association, and the American Electroplaters' Society. His articles on sales promotion and other business subjects have been published in Printers' Ink, Industrial Marketing, The Office Economist, Business Education World, and other periodicals.

York Electro-Cast Corp. Expands Facilities

Expansion of the line of pure copper castings produced electrolytically by the *York Electro-Cast Corporation* will take place in August when the corporation moves into a newly purchased plant at Spry, Penn.

Twenty-five workers will be employed in producing memorial markers, plaques, honor rolls, furniture hardware, drawer-pulls, gift items, and busts and plaques of national figures such as *Henry Ford*.

The electrolytic deposition process, invented and developed by *A. O. Ross*, the president, is claimed to permit the reproduction of the finest detail in pure copper. The sharpness of detail is far greater than can be produced in stampings or sand castings and is limited only by the amount of sharpness in the original design.

Mr. Ross was in charge of development of copper clad steel for the *Follensbee Steel Company* during the war. He went to York in 1943 to form the corporation, which was financially expanded on April 1, 1947.

H-VW-M Builds New Research Laboratory and Test Plant

A new research laboratory and test plant is being erected by *Hanson-Van Winkle-Munning Company* on their property at the corner of Church Street and Price Street, Matawan, N. J. The new building will incorporate an ideal environment and every facility for conducting research and development of the Company's products. The activities of the laboratory will further provide for experimental and test plant operations to establish each customer's specific requirements in equipment and supplies.

The layout of the laboratory provides a grouping of the various functions in close proximity to provide an efficient arrangement for carrying out all of its activities. A maximum of natural lighting, acoustical facility, mechanically filtered air ventilation and the studied use of materials will all be conducive to a congenial environment for creative work.

The new building, connecting with the present laboratory, will be approximately 50 ft. x 70 ft., three stories in height and constructed of steel framing.

A large area on the first floor of the building will be devoted to the most advanced equipment and facilities for research and experimentation in plating processes of all kinds. The filtered air supply system will provide warm air in winter and cooled air in summer and is arranged to change the air completely every one and one half minutes. The electric system will distribute both alternating and direct current at several different voltages. The floor of this area will be constructed of acid proof brick laid in acid proof mastic with an extensive system of gutters to provide rapid floor drainage at all times. The walls of this area will be of tile in a pleasing color.

Additional laboratories on the first floor will include one for the preparation of special solutions, an enamel and coatings laboratory, a buffing and polishing section and a corrosion testing laboratory.

The second floor will have the offices for the Director of Research and the laboratory staff, a large combination library and conference room, chemical research laboratories, a

all One Price

ONE SOLVENT FOR ALL METALS OR COMBINATION OF METALS

NEW SCIENTIFICALLY IMPROVED

BLACOSOLV

Now all metals or combinations of metals may be scientifically degreased with the same solvent. You need not pay premium prices for special solvents for different metals. The new, improved BLACOSOLV is the most highly stabilized degreasing solvent for use in solvent vapor degreasers. It can be used over and over again without impairing its high qualities. BLACOSOLV is non-inflammable . . . has a low boiling point (188° F.) . . . Does not affect or stain even the most highly polished surfaces.

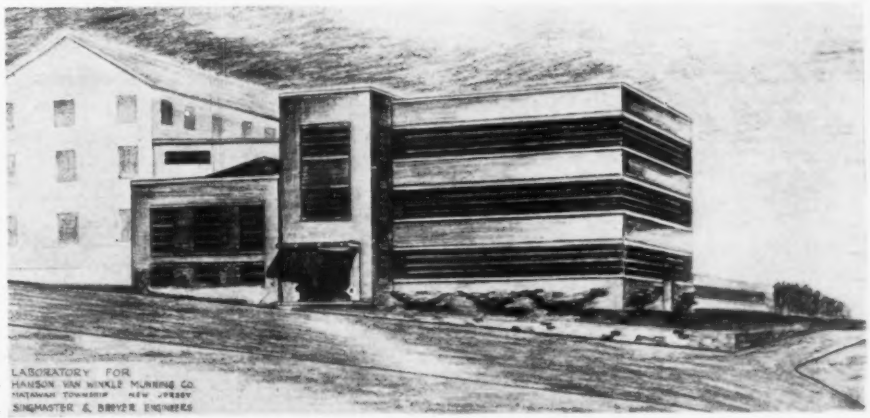
Write today for FREE booklet on Degreasers and application with Blacosolv the all purpose degreasing solvent.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.



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99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and over a hundred years of technical background, Mutual is the world's foremost manufacturer of Chromic Acid.

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Bichromate of Soda

Bichromate of Potash

MUTUAL CHEMICAL COMPANY OF AMERICA

270 MADISON AVENUE — NEW YORK 16, N.Y.

FOR FASTER CUTTING
INCREASED PRODUCTION . . .
GREATER ECONOMY . . .

HARRISON 4A PRODUCTS

Uniform, quality compounds for
BUFFING and POLISHING!

Double Header Compounds in Sizes — 150—180—220—240 & 320

• Our Stainless Steel Polishing Compounds are giving satisfaction to many of the country's leading companies. Quality is maintained at all times, so that you can order with confidence.

Write us at any time in regard to special problems. We will be glad to advise you and send samples of compounds that will meet your special needs.

HARRISON & COMPANY, INC.

HAVERHILL, MASSACHUSETTS

metallographic laboratory, dark rooms, a balance room and supply rooms.

The third floor will be arranged for a suite of offices for the executive officers of the company, a Board of Directors Room and a conference room. Additional offices will also be provided on the third floor for the laboratory, engineering and clerical personnel. It is expected that the new laboratory will be completed by the end of the year.

Goble Heads Kelite in Atlantic States

The interests in the Atlantic States of *Kelite Products, Inc.*, manufacturers of industrial chemicals for cleaning and processing, were taken over by *Kelite Products Company* of Flushing, New York, under the direction of *Mr. Gene Goble.* As president and general manager of *Goble Aircraft Specialties, Inc.*, Mr. Goble is widely known throughout the East as a manufacturer of interior trimmings for luxury airliners, aircraft engine parts and instruments and tools. A resident of Garden City, New York, he is vice-president of the Kiwanis Club of the New York airport, a member of the Wings Club and the Admirals Club.

At present, the organization consists of fifty trained sales and service personnel. This will be expanded to take care of Kelite's rapidly growing interests on the Atlantic seaboard. Complete stocks of Kelite materials are now on hand, and the Flushing, New York office now has all facilities available to service present and prospective accounts in the Atlantic States.

Gene Goble

Nelson Chemicals Appoints Gordon R. Smith

Announcement has been made by *Nelson Chemical Company*, Windsor, Ontario, of the appointment of *Gordon R. Smith* as sales manager for Canada in charge of the company's *Gripmaster Division*.

Gordon R. Smith

In his new capacity, Mr. Smith, who has been with Nelson for the past four years in various sales capacities, will direct sales for the firm's polishing wheel cement, which is now marketed coast to coast in Canada, as well as in the United States and several foreign countries.

Nelson Chemical Company, Windsor, is an affiliate of Nelson Chemicals Corporation, Detroit, Michigan.

Colonel Fletcher Joins Sam Tour & Co.

Sam Tour & Co., Inc. and its affiliate the *American Standards Testing Bureau, Inc.*, both of 44 Trinity Place, New York City, announce the appointment of *Col. Leslie S. Fletcher* as technical director.

Col. Fletcher is being retired from the Regular Army for physical disability; he has completed twenty-three years commissioned service. He graduated from the United States Military Academy at West Point in 1924.

After serving two years in the Field Artillery, he was transferred to the Ordnance Department. Upon his return from Hawaii, he spent two years in Post Graduate work in Mechanical Engineering at M.I.T. and in Metallurgical Engineering at Watertown Arsenal. After graduating from the Ordnance School in 1932, he spent four years as director of the laboratories at Rock Island Arsenal.

In 1936 Col. Fletcher was transferred to Frankford Arsenal. For two years he was closely connected with mechanical time fuze development. Then he became military director of the Frankford Arsenal Ordnance Laboratory. During the four years in which he was the Officer in Charge of this Laboratory, it was expanded from a small fifteen-man organization to a laboratory occupying its own buildings and employing over three hundred scientists and technicians.

In the Summer of 1945, Col. Fletcher was sent to the Pacific Theatre. He arrived in Manila several weeks before V.J. day.

Besides his campaign ribbons with their many battle stars, Col. Fletcher has the Bronze Star Medal with Oak Leaf Cluster and the Army Commendation Ribbon.

Col. Fletcher has been active in many organizations. He is a past chairman Tri-City Chapter, American Society for Metals; Treasurer and Chairman Educational Committee, Philadalphia Chapter, American So-

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for Big Game Hunters

The Lyman Gun Sight Corporation has a high reputation among the world's big game hunters, from the African "cat" country to the crags of Alaska, for producing accurate, dependable precision sighting instruments for use on the world's finest hunting rifles.

Hunters hunt in every clime; they hunt in every kind of weather. To help keep their famed sights accurate in the field, Lyman finishes *all* their steel parts in DU-LITE Black Oxide Finish.

Lyman selects DU-LITE because it imparts to the gun sight a rust-resistant, oil-absorptive finish—factors essential to durability. And Lyman selects DU-LITE because it is imposed at non-critical temperatures and causes no dimensional changes in the finished parts — important considerations in close-tolerance manufacture.

DU-LITE will solve your steel finishing problems for you, too. Call or write. We will be glad to arrange for a DU-LITE Service Engineer to call on you at your convenience.

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Because the filter cake is held horizontally, it is absolutely stable to the end of each filtering cycle. And cycles are longer because the cake retains its porosity longer. That is why the "horizontal principle," as embodied in Sparkler filters, gives you more efficient, low cost, operation. Sparkler filters are pressure-tight and leak-proof, designed for intermittent or continuous operation.

4 Plating Solution Types

1. Rubber-lined for bright nickel
2. Stainless steel for acids
3. All Iron for alkaline solutions
4. All Steel (with Stainless Pump) for chromium

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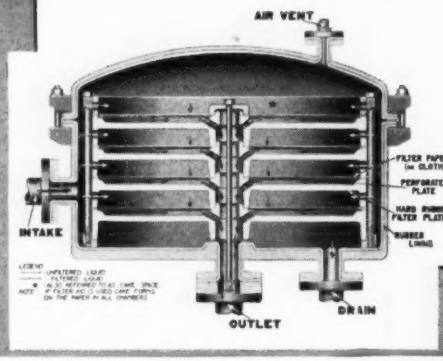

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See your supplier or Write for details

Our Engineering Service is available for any specialized problems.

ciety for Metals. He has served on several A.S.T.M. committees. He is a member of A.I.M.E. He is also a former member of both the Moline, Illinois, and Philadelphia Rotary Clubs.

News from California

Price-Pfister Manufacturing Company, 3011 Humboldt Ave., Los Angeles, has installed some $50,000 worth of new equipment for use in finishing plumbing hardware. Among the major items are an automatic cleaning machine and a partially automatic copper and nickel installation for bright nickel and chrome plating plumbing hardware.

A baseball game with teams composed of platers and representatives of plating supply companies opposing each other was scheduled to be the feature items of the entertainment program at the annual picnic of *Los Angeles Branch, American Electroplaters' Society* at Ladera Park, Los Angeles, Sunday, August 10. Picnic *Chairman Jack Bealle* appointed *Roy Lostetter* of the *Joseph V. Murry Hard Chrome Products Company* as manager of the "Platers" team, and *Herold Kroesche* of *Harshaw-Chemical Company* as manager of the "Suppliers" team. *Don Bedwell*, superintendent of *Hallenscheid-McDonald Company* was scheduled to serve as umpire. An attendance of some 200 members, their families and friends was anticipated.

TECHNICAL LITERATURE

Labor Act Explained

How to Operate Under the New Labor Law. Published by the Labor Relations Institute, New York. Price, $2.00. The effect of the new Labor-Management Relations (Taft-Hartley) Act upon employers, unions and employees is set forth in practical terms in this timely report. It is more than an analysis of the new law governing employer-employee relations; it views the new statutes against the background on the Wagner Act—now largely superseded—and measures its effect in states which have even more restrictive state laws. It tells in exactly what ways management's position is improved and strengthened; what individual rights previously denied to workers now can be exercised by the latter. It sets forth the new limitations placed on unions—and outlines the added powers accruing to Government under this new law.

The analysis of state regulations, presented in chart form in this manual, will prove equally helpful to employers — especially those with plants in one or more of the states affected. Pointing out that the new Act permits state law to govern in all instances where the latter are more restrictive with respect to union security than the federal statute, the authors go on to list the states which regulate the following: union security, check-off of dues, strike votes and strikes in public utilities, and registration of unions.

Another helpful feature is an item-by-item comparison of the Wagner Act and the Taft-Hartley Act, telling how each stands in relation to 21 key matters, including: NLRB, certification of unions, unfair labor practices, reinstatement and back pay, individual bargaining, "free speech," secret ballots, closed shop and union shop, check-off, termination of contracts, union liability, union regulation, Communist leadership, injunctions and restraining orders, rules of evidence, statute of limitations, foremen, health and welfare funds, craft versus industrial units, and national emergencies.

The manual closes with an excerpted text of the new law.

Copies may be obtained by non-members of the Labor Relations Institute, by writing to the latter's headquarters, 1776 Broadway, New York 19, New York.

Reclaiming Pickling Liquor

The original strength of spent pickling liquor can be restored by the addition of ethyl alcohol followed by fractional distillation according to a recent German technical monograph prepared by the Office of Technical Services, Department of Commerce.

The paper (in English) was written for the Field Information Agency, Technical, Office of Military Government, by Edmund R. Thews, a German consulting engineer.

Four methods now being used to evaluate or regenerate old and super-concentrated pickling liquors are discussed: Precipitating the excessive iron and sacrificing the acid solution, electrolytic deposition of iron and regeneration of the acid, freezing out most of the ferrous sulphate and regeneration of the acid, and separation of all the ferrous sulphate by addition of ethyl alcohol and regeneration of the acid.

The alcohol method is a very efficient and economical process for removing practically all iron and regaining all the acid solution for further pickling use, the report states.

Orders for the report (*PB*-44958; *Contribution to the Regeneration of Pickling Solutions;* photostat, $1; microfilm, $1; 6 pages; dated July 1946) should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order, payable to the Treasurer of the United States.

Manufacturers' Literature

Handbook on Nickel and High Nickel Alloys

A compressed handbook and guide *Nickel and High Nickel Alloys* is being distributed by *The International Nickel Company*. Written by *Dr. Norman E. Woldman*, consulting metallurgical engineer and former chief metallurgist for *Bendix Aviation Corporation*, it originally appeared in the technical press and has been made available in convenient reprint form. In addition to information on nickel, Monel, Inconel, and associated alloys it also includes material on such other alloys as the Hastelloys and Illium. Dr. Woldman reports on properties, heat and corrosion resistance, as well as on modern fabrication and finishing practices. It will be sent on request to The International Nickel Company, Inc., Dept. MF, 67 Wall St., New York 5, N. Y.

Selenium Rectifiers

The manufacturing division of *Bart-Messing Corporation*, now have available literature on the first two "Sel-Rex" selenium rectifiers they have designed and have in production.

The first two models are 500 and 1500 amperes. The firm is well known in the metal finishing industry and fully aware of the "bugs" common in conversion units. The literature discloses some revolutionary modifications in rectifier design that greatly increase selenium rectifier efficiency and economy in operation. Electroplating plants are encouraged to submit their problems to the Metal Finishing Engineering Department of the Bart-Messing Corporation and they will endeavor to help at no obligation on the part of the inquirer.

Literature is free and available by writing to Bart-Messing Corporation., Dept. MF, 45 Morgan Ave., Brooklyn 6, N. Y.

Engineering Data Book

A fully illustrated 12 page bulletin on voltage control has recently been released by the *Superior Electric Company* of Bristol, Connecticut. This new *Bulletin No.* 547 features the latest developments in *Powerstat* variable transformers and *Stabiline* automatic voltage regulators. All the information on voltage control equipment necessary to management, designers, and engineers has been included in concise, easily read form. Bulletin No. 547 is complete with ratings, detail drawings, photographs, and performance and engineering data.

Direct requests for the booklet to *The Superior Electric Company*, Dept. MF, 286 Church St., Bristol, Conn.

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Write for Bulletin 1650

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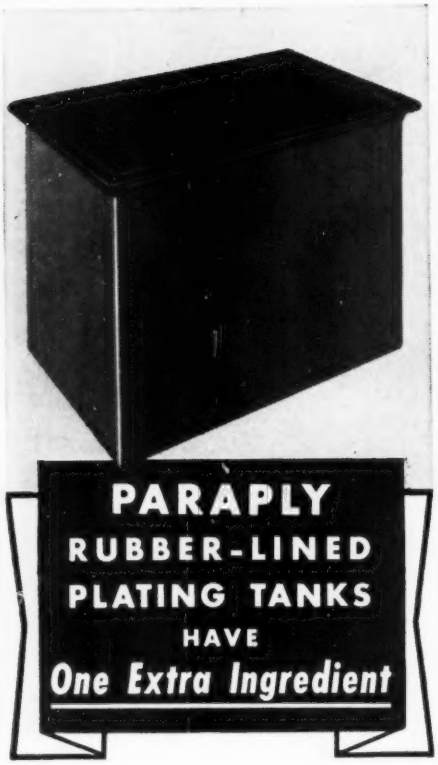

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Frankly, we never are, until we're absolutely sure that each "U. S." Paraply rubber-lined tank will do an even better job than our customer expects.

Of the hundreds of Paraply rubber-lined plating tanks we have installed during the last few years, just two have failed to measure up to this standard of service.

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Paraply Rubber-Lined Tanks are a Product of

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Available through your local plating supply dealer, or write direct.

Filtration Equipment

The *Titeflex* filter, which is said to feature simplicity of operation with ease of cleaning, is illustrated and described in a folder just published by Titeflex, Inc., 414 Frelinghuysen Ave., Newark 5, N. J. Also illustrated and described is the Titeflex all stainless laboratory filter.

Copies free on request by writing the firm as above.

Rack Insulation

Peninsular Chemical Products Company announces an illustrated bulletin on *Pen-Kote* 590—a non-inflammable, odorless Saran-base rack coating, which is claimed to withstand chlorinated degreasing solvents as well as all plating and cleaning solutions.

Unretouched photos show how this coating is quickly applied by hand dipping, without bridging or webbing; and other advantages are illustrated and described in detail. A free trial offer is included.

Copies of the bulletin are available upon request from Peninsular Chemical Products Company, Dept. MF, 6795 East Nine Mile Rd., Van Dyke, Mich.

Protective Equipment Coating

A four-page, two-color pamphlet giving details of and uses for *Koppers Bituplastic*, a new plastic protective coating that waterproofs and vapor seals has recently been published. Listed is its special adaptability for use on above ground tanks, gas holders, railings, fire escapes, ornamental iron work, gutters, storage tanks and towers, cooling towers, metal buildings, roofs and its ability to waterproof and dampproof any wall surface of metal, masonry or concrete. The booklet also provides details regarding its quick drying, fire retardancy, ability to withstand temperture extremes, and applicability with brush or spray and provides data on types of Bituplastic and special recommendations for use of each type. For copies, write *Wailes Dove-Hermiston Corporation*, Westfield, N. J.

Metal Cleaning Analysis

The Nielco Laboratories has published a pamphlet concerning metal cleaning entitled *Facts and Figures on Metal Cleaning Operations*. This copyrighted publication deals with a report based on a survey of some 300 plants.

The purpose of the paper is to give those having cleaning operations a means whereby they can quickly determine what the specific cleaning operation they have in mind will require in capital investment as well as in daily, monthly or yearly chemical consumption. The figures arrived at are determined by methods fully explained in the report.

The chemical costs of various metal cleaning methods are quite complete in description, so as to establish cost figures as close as possible to the average plant costs of operation. Of particular interest to the average plant executive should be the Chemical and Equipment Cost table. This table lists the average costs of the complete procedures, including chemicals and equipment.

A copy of this publication may be obtained by writing to the Nielco Laboratories, Dept. MF, 8129 Lyndon, Detroit 21, Mich.

Handbook for Users of Abrasive Wheels

Charles H. Besly and Company, Chicago, Ill., have recently issued a new pocket-sized 48-page handbook for industrial users of abrasive wheels, particularly *Besly-Titan* abrasive wheels.

The new booklet explains the advantages of *Steelbac* grinding discs, a bolted-on product. Reasons for perforations in the discs are clearly outlined and a full explanation for the use of resinoid bond is given.

Following this section is a standard marketing system chart for Besly-Titan abrasive wheels and a series of price list tables. Other informative subjects covered include 1) types of grain used in making these abrasive wheels, 2) porosity control and 3) types and uses of coolants.

The concluding section of the booklet includes photographs and descriptions of five wet Besly grinders, two dry grinders and a piston ring finishing machine.

The Besly Company is a manufacturer of equipment for production grinding from the smallest pieces to large steel castings. For information on the new grinders and a free copy of the booklet *Besly-Titan Abrasive Wheels* write to Chas. H. Besly and Company, Dept. MF, 118-124 N. Clinton St., Chicago 6.

Letters to the Editor

The Editor,
Metal Finishing,
11 West 42d Street,
New York City 18

Sir:

I read with interest the article on aluminum electroplating in America, published in your May number, because as a boy and college student in Philadelphia, I had also heard of the electroplating of aluminum on the parts of the Philadelphia City Hall. This article is an interesting reminder of the beliefs regarding electroplating that were held 55 years ago. I feel that it should not be published without calling attention to the fact that nobody has since then clearly demonstrated that metallic aluminum can be electrodeposited from an aqueous solution.

While a student at the University of Pennsylvania, I was informed that the bath used by Mr. Darling consisted primarily of zinc sulfate to which an aluminum salt was added. In the light of our present knowledge, it is probable that the deposit then applied consisted of zinc and not of aluminum. I do not know whether any of the original coatings are still present on these columns, on which a test for the presence of aluminum might be made.

Very truly yours
W. Blum, Chief,
Electrochemistry Section,
Division of Chemistry,
National Bureau of Standards.

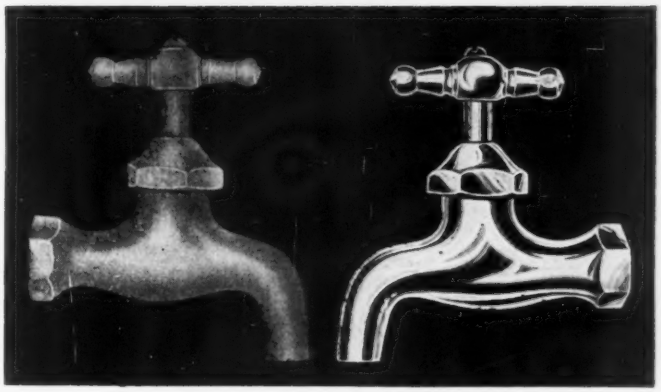
Editor
Metal Finishing
11 West 42nd Street
New York 18, New York

Dear Sir:

On page 100 of the June, 1947, issue of *Metal Finishing*, you reply to one of your readers on a question pertaining to electropolishing. Your reply states "The Battelle Development Company, Columbus, Ohio, holds basic patents on various processes, and they license Hanson-Van Winkle-Munning to manufacture the equipment for use of the processes."

It is true that the Battelle Development Corporation does hold basic patents on various electropolishing processes and baths, and the articles

BRILLIANT LUSTROUS DEPOSITS WITHOUT COLOR BUFFING ... AN IDEAL BASE FOR CHROMIUM



NEW IMPROVED
Lustrebright
Bright Nickel Process

Produces Brilliant, Lustrous, Adherent Nickel Deposits • Elminates Color Buffing — Re-Cleaning — Re-Racking • An Ideal Base for Chromium • Excellent Throwing Power • No Special Solutions or Changes in Equipment Required • Easy to Control • Low in Cost • Successful • Practical.

Gives uniform results and continuous operation on all classes of work in still tanks and mechanical barrels. Substantially reduces plating costs. Brilliant, lustrous, nickel deposits that may be chromium plated, are produced by merely adding NEW IMPROVED LUSTREBRIGHT to your present cold nickel solution, if of standard formula.
Work comes from plating tanks with bright, fine grained, adherent deposits. No color buffing or burnishing is required. Work may be transferred direct from nickel to chromium bath, without intermediary buffing, re-cleaning, or re-racking. Excellent for zinc die-castings.
GUARANTEED NOT TO HARM PLATING SOLUTION. Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTREBRIGHT. Write for complete information.

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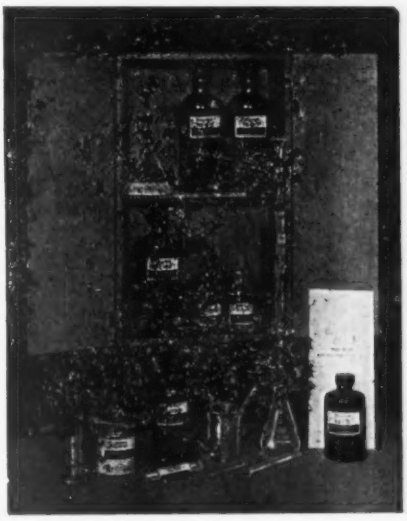

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treated by electropolishing. It does not, however, license Hanson-Van Winkle-Munning, or any other manufacturer, to manufacture equipment for use with the processes.

It is the policy of this Corporation to grant non-exclusive licenses to companies which can use the process for commercial production. Our licensees may purchase equipment and chemicals from any source they desire.

We trust that this information will correct an erroneous impression on the part of your staff of writers.

Yours cordially,
John S. Crout
Battelle Development Corp.

Associations and Societies

AMERICAN SOCIETY FOR METALS

Slightly more than 90% of the 240,000 square feet of available floor space in Chicago's International Amphitheatre have been reserved for the coming *National Metal Exposition*, October 18th to 24th, 1947.

According to *W. H. Eiseman*, managing director of the Exposition and secretary of the *American Society for Metals*, 277 industrial exhibitors have been assigned space in the industry's largest annual exposition. Floor plans had previously been sent only to former exhibitors in the Metal Show. Other companies will receive floor plans on or about July 15th. Because of the unprecedented demand for exhibit space in 1947, it is anticipated that the entire available area will be quickly reserved.

The October Metal Show will mark the first time that the national event has been held longer than 5 days. Former expositions have opened on Monday and closed on Friday night. The 1947 event, however, will be opened on Saturday October 18th, and continue until the following Friday night. Thus, two additional days have been added to the Show schedule. Because Chicago is a major center of the metals industries, it is believed that attendance "by invitation only" on the first two days of the event will draw large numbers of interested engineers and technical personnel from the Chicago area. Since annual technical sessions of four major technological societies will open on Monday, October 20th, it appears that most of the out-of-Chicago-area visitors will attend the Exposition during the week of the technical sessions.

The National Metals Exposition, sponsored by the American Society for Metals, will be held concurrently with the *National Metals Congress*. In addition to the ASM, technical meetings during the week will be held by the *American Industrial Radium and X-Ray Society*, the *American Welding Society*, the *Iron and Steel Division* and the *Institute of Metals Division* of the *American Institute of Mining and Metallurgical Engineers*.

The Publications Committee of the

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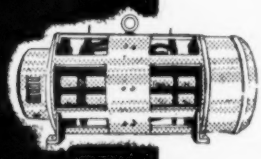
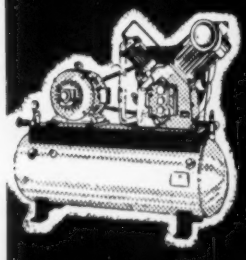
Motor Generator Sets, Plating Rheostats, Tanks for all purposes, Plating Barrels, Agitators, and practically everything for the Plating Department.





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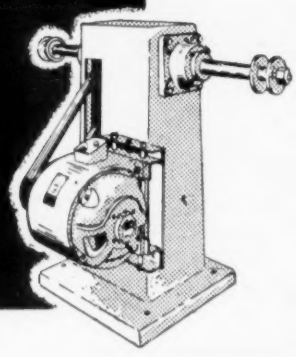

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INDUSTRIAL CHEMICALS FOR CLEANING & PROCESSING
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LOS ANGELES • CHICAGO • DALLAS • AUSTRALIA

American Society for Metals will meet in Cleveland on July 25th to select the technical papers which will be presented before the Society's annual meeting. Announcements of the program details will be made at a later date.

THE ELECTROCHEMICAL SOCIETY

Dr. R. M. Burns, chemical director of *Bell Telephone Laboratories*, is the newly appointed secretary of *The Electrochemical Society, Inc.* Dr. Burns succeeds *Dr. Colin Fink*, who

Dr. R. M. Burns

has retired after 26 years service with the Society.

Dr. Burns was born at Longmont, Colorado and is a graduate of the University of Colorado, which institution recently conferred on him the honorary D. Sc. degree. He was awarded a Princeton University Fellowship in 1920 and received his Ph. D. from there in 1921. Dr. Burns was treasurer of the Electrochemical Society from 1932 to 1943, and president in 1943. He is also a member of the American Chemical Society, the American Association for Advancement of Science, the New York Academy of Sciences and the New York Chemists' Club.

A new assistant secretary, *Mr. John W. Cornwall*, has been appointed. Mr. Cornwall is a recent Dartmouth graduate with service as an engineering officer in the U. S. Navy during the latter part of the war.

The new address of the secretary is 235 West 102nd St., New York 25, N. Y.

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Metal Finishing August

AMERICAN ELECTROPLATERS' SOCIETY

Research Project No. 10

The *American Electroplaters' Society* has recently announced the establishment of a new research project on *The Disposal of Plating Room Wastes.* This is the tenth of a series of projects which have been set up as fellowships or grants at leading universities and research institutions throughout the country relating to various practical aspects of the electroplating and metal finishing industry. These projects are supported by allotments from regular membership dues, by voluntary contributions, and by industrial concerns through payment of Sustaining Membership dues to the Society.

Research Project No. 10 has been located at Yale University, with *Professor Barnett F. Dodge*, head of the Department of Chemical Engineering, as Project Director, and *Mr. D. C. Reams*, instructor in Chemical Engineering, as Research Associate. The Project Directing Committee consists of *Dr. C. Fred Gurnham*, chairman; *Mr. Malcolm A. Orr;* and *Mr. Manley L. Ross.* This Project Directing Committee is part of the Research Directing Sub-Committee of which *Dr. R. H. Wick* is chairman and *Dr. Louis Weisberg*, and *Mr. W. M. Tucker* are vice-chairmen. *Mr. E. T. Candee* is Chairman of the Research Committee organization.

The project currently comprises an extensive survey and critical review of the existing literature in this field. This will be followed by laboratory and pilot plant investigations and by cooperative work in industrial treatment plants. Progress and final reports will be published in The Monthly Review, official journal of the Society, and as A.E.S. Research Reprints.

AMERICAN SOCIETY FOR TESTING MATERIALS

The 1947 annual meeting of the *American Society for Testing Materials*, the fiftieth held since the first one in Philadelphia in 1898, focused attention on a number of important activities involving standardization and research in materials. Throughout the week of the meeting in Atlantic City beginning June 1[illegible] there were about 350 meetings of the Society's technical committees and of the nineteen technical sessions scheduled at which many papers and reports were presented.

The total registered attendance at the meeting was 1781 compared with the previous high in New York in 1944 of 2063, and Buffalo in 1946 of 1835.

As a result of recommendations by the technical committees the Society approved 43 new tentative specifications and tests and 70 previously published tentatives are to be adopted as formal standards. Standards recommendations were pretty well divided throughout the Society's field of work, although the Steel Committee, as a result of intensive activity during the week, reported seven new specifications.

T. A. Boyd, General Motors Corp., was elected president for 1947-1948, succeeding *Arthur W. Carpenter*, The B. F. Goodrich Co., who continues on the board of directors as past-president for three years. *J. G. Morrow*, Steel

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DYESTUFFS and CHEMICALS necessary for Anodizing and Dyeing Aluminum now available.

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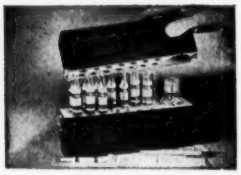

The active acidity and alkalinity of electroplating and electrotyping baths (*) for the uniform deposition of metal are now universally controlled by the pH method. LaMotte Block Comparators are standard equipment in this field. They are also required for careful pH control of Metal Cleaning Solutions(*). Price each $12.50 f.o.b. Towson, Md.

The LaMotte Acid-Copper Analytical Set

For accurately determining and regulating both the acid and copper content of the bath. Price $18.00 f.o.b. Towson, Md.

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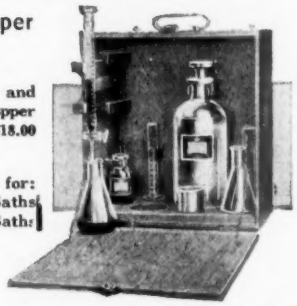
(Prices upon request)



The LaMotte Plating Control Unit, Model U7

This LaMotte Outfit provides for the control of Acid Copper, Cyanide Copper, Acid Zinc, Cyanide Zinc, Cadmium, Brass and Bronze Plating solutions.

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(*) Reports on various Plating Control Processes are available without obligation. Write for them.

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Company of Canada, Ltd., is the new vice-president to serve with *Senior Vice-President R. L. Templin*, Aluminum Company of America. The new members of the board of directors are as follows:

T. S. Fuller, General Electric Co.; *Everett G. Ham*, John A. Manning Paper Co., Inc.; *J. J. Laudig*, Delaware, Lackawanna & Western Railroad Co.; *H. L. Maxwell*, E. I. du Pont de Nemours and Co., Inc.; and *Louis J. Trostel*, General Refractories Co. Laboratories. *Gerald C. MacDonald*, Montgomery Ward and Co., has been appointed to the board of directors to fill an unexpired term. His term will carry through 1949.

Three engineering leaders, long-time and active members of the Society, and each a past-president were awarded honorary memberships. They are as follows: *F. Malcolm Farmer*, Electrical Testing Laboratories, Inc.; *Arno C. Fieldner*, U. S. Bureau of Mines; *H. S. Vassar*, Public Service Electric and Gas Co.

It was announced that the 1948 Annual Meeting of the Society will be held in Detroit during the week of June 21-25 and in conjunction with this will be the Eighth Exhibit of Testing Apparatus and Related Equipment. The 1948 Committee Week and Spring Meeting will be held in Washington during the week of March 1-5. In addition, a number of A.S.T.M. technical committees will either hold group sessions separately or may combine with other committees in the same fields for three or four-day meetings in the fall or spring.

Electrodepositors' Technical Society

The *Electrodepositors' Technical Society*, which is the English equivalent of the *American Electroplaters' Society*, has arranged to hold the first post-war International Conference, on Electrodeposition in London, England, in September, 1947.

The actual sessions of the conference will be held on Wednesday and Thursday, September 17 and 18, while other events associated with the conference will continue on Friday and Saturday, September 19 and 20. All sessions of the Conference will be held at the Hyde Park Hotel, Kensington, London, S.W.1., England.

A number of plant visitations is

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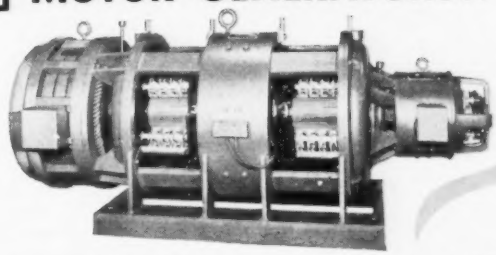

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being planned, both in London and the Midlands area. An exhibition will be also given of recent developments in electrodeposition research and practice. Demonstrations of testing equipment, etc., will be carried out on Friday morning, September 19.

The following papers will be given at the conference:

Wednesday, September 17, at 2:00 P. M. to 5:00 P.M.

Chairman: *Dr. S. Wernick*, president, E.T.S.

P. Jacquet (France), Electrolytic Polishing (Scientific Applications).

M. Halut (France), Electrolytic Polishing (Technical Applications).

H. C. J. Decker, A. P. L. Krijff and *J. M. Plunt* (Holland), Some Special Applications of Electropolishing.

P. Berger (Gt. Britain), Electrolytic Polishing of Brass Pressings.

E. Farmer (Gt. Britain), Motion Study and Training in Metal Polishing.

Wednesday, September 17, 5:30 P.M. to 8:00 P.M.

Chairman: *Prof. R. S. Hutton*, past president, E.T.S.

H. A. Holden (Gt. Britain), Chemical Treatments for Zinc Surfaces—A Review.

H. E. Arblaster (Australia), Recent Work in Silver Plating in Australia.

R. M. Wick (U. S. A.), American Electroplaters' Society Research Work.

A. M. Wallbank and others (Gt. Britain), German Electroplating Practice.

W. F. Coson (Gt. Britain), Continental Trends in Metal Finishing—A Visitor's Impressions.

J. Van der Sommen (Holland), title later.

C. D. B. Williams (Gt. Britain), Porous Chromium Plating by the Van der Horst Process.

Thursday, September 18, 10:00 A.M. to 1:00 P.M.

Chairman: *Dr. G. E. Gardam*, vice-president, E.T.S.

P. Baeyens (Holland), The Effect of Operating Conditions on the Throwing Power of Cyanide Cadmium Plating Solutions.

S. Wernick and *F. Willets* (Gt. Britain), Electrodeposition of Nickel as a manufacturing Operation.

R. Piontelli and *L. Canonico* (Italy), Electrodeposition of Metals from Sulphanate Baths.

R. R. Rogers and *M. Boyd* (Canada), Electrodeposition of Corrosion

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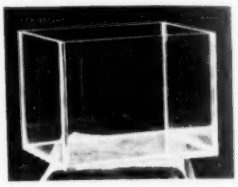

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Resistant Metallic Coatings on Magnesium Alloys.

A. Brenner (U. S. A.), The Electrodeposition of Alloys of Tungsten with Iron, Nickel and Cobalt.

N. A. Tope (Gt. Britain), Experiences with Rochelle Salt Copper.

Thursday, September 18, 2:30 P.M. to 5:00 P.M.

Chairman: *N. A. Tope*, chairman, Midlands Centre E.T.C.

R. Piontelli (Italy), On the Influence of the Basis Metal on the Electrodeposition of Metals.

A. T. Steer, (Gt. Britain), The Mechanism of the Exfoliation of Electrodeposited Surfaces.

U. R. Evans (Gt. Britain), Tarnishing and Related Phenomena.

J. J. Dale (Australia), The Structure of Bright Chromium Electrodeposits.

T. Banerjee (India), Experiments on the Electrodeposition of Brass.

G. E. Gardam (Gt. Britain), Mechanism of Bright Nickel Plating.

All inquiries and communications should be addressed to Conference Secretary, Third International Electrodeposition Conference, Electrodepositors' Technical Society, 27, Islington High Street, N. 1., London, England.

ABSTRACTS

(*Continued from page 54*)

field is to develop simpler, cheaper and more flexible processes than are now available.

One good method of approach to the problem is to use one waste to neutralize another; another method is to treat wastes for re-use; still another is a combination of the first two.

In acid wastes containing metal cations, additions of an alkali will neutralize the acid and precipitate all heavy metals; the alkali may be caustic soda, soda ash, quick lime, hydrated lime or limestone. Limestone in lump form disposed in beds through which the waste is caused to flow is probably the cheapest treating agent but is limited in that it is not successful where the acid solutions contain heavy metal ions.

In acid wastes containing chromate, the usual method is to reduce the hexavalent chromium to its trivalent state by means of a reducing agent whereupon the chromium can be precipitated by lime just as other metal

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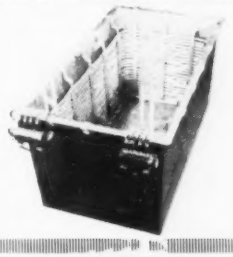
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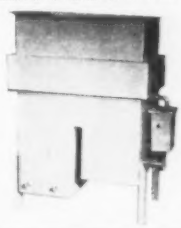
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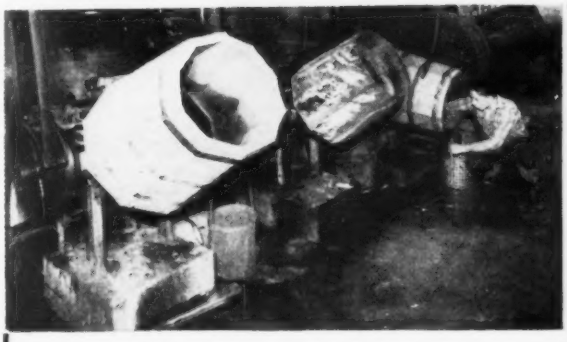

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cations. Common reducing agents used for this purpose are metallic iron, metallic zinc, SO_2, sodium sulphite, sodium bisulphite, sodium or other sulphides, zinc hydrosulphite and ferrous sulphate.

In cyanide wastes, one of the oldest methods involves acidification with sulphuric acid or acid wastes to a pH of about 4 followed by boiling or blowing with air to liberate HCN gas. The cyanide of the metal in the waste is precipitated as a sludge. If an excess of acidity remains, the liquor may be further treated with lime before discharge. A fairly recent method makes use of chlorine to oxidize the CN radical to cyanate, CNO, which is much less toxic. The reaction is carried out at a controlled pH of above 8.5 (generally 11-12) and requires about 4 parts of chlorine per part of CN, with sufficient alkali to maintain the proper pH. If the CNO is objectionable, a further addition of 4 parts of chlorine will oxidize the cyanates to carbonates.

Ion exchange equipment, in which synthetic resinous materials having the power of exchanging one cation for another have been developed. This type of equipment has many advantages; it may be adapted to continuous treatment and there is the possibility of being able to affect a separation of metals from their salts if recovery is desired.

The authors reviewed tested methods for treatment of plating room wastes and cited several examples of treatment processes in actual operation in various plants throughout the country. Among those described were treatment of chromium plating wastes: disposal of cyanide and chromate wastes; a treatment plant for copper, nickel chromium and acid wastes, including a separate installation for copper cyanide waste; rinse waters from silver plating operations; pilot plant for treatment of brass pickling wastes.

The winner of the Pontiac convertible automobile which was awarded at the Exposition was Harry Carlson, four week old son of George Carlson of Acme Manufacturing Company, Detroit. The silverware set was won by E. J. Roedl of International Nickel Company, Bayonne, N. J.

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